

United States Air Force Research Laboratory

PERFORMANCE ASSESSMENT OF DYNASPEAK SPEECH RECOGNITION SYSTEM ON INFLIGHT DATABASES

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SEPTEMBER 2004

FINAL REPORT FOR THE PERIOD JUNE 2004 TO
SEPTEMBER 2004

20050201 016

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AFRL-HE-WP-TR-2004-0163

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REPORT DOCUMENTATION PAGE				Form Approved OMB No. 0704-0188	
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1. REPORT DATE (DD-MM-YYYY) September 2004		2. REPORT TYPE Final Report		3. DATES COVERED (From - To) June 2004 - September 2004	
4. TITLE AND SUBTITLE Performance Assessment of DynaSpeak Speech Recognition System on In-Flight Databases				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER 62202F	
				5d. PROJECT NUMBER 7184	
6. AUTHOR(S) Timothy P. Barry* David T. Williamson				5e. TASK NUMBER 10	
				5f. WORK UNIT NUMBER 02	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) General Dynamics * Advanced Information Systems 5200 Springfield Pk Dayton, OH 45431				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) Air Force Research Laboratory Human Effectiveness Directorate Warfighter Interface Division Air Force Materiel Command Wright-Patterson AFB, OH 45433-7022				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S) AFRL-HE-WP-TR-2004-0163	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution is unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT Automatic speech recognition has demonstrated the potential to provide a natural interface to computing systems. For the military, the realization of this natural interface will depend on a robust speech recognition technology that is capable of handling the degraded speech conditions typical of the military aircraft environment. To aid in the assessment of various commercially available speech recognition systems, several aircraft speech databases have been developed at the Air Force Research Laboratory's Human Effectiveness Directorate. These databases attempt to capture the degraded audio conditions typical in the military airborne environment. This report discusses the results of an extensive evaluation of the DynaSpeak v1.4.1 speech recognition system developed by Stanford Research Institute (SRI) using three different aircraft speech databases to benchmark its performance.					
15. SUBJECT TERMS Speech Recognition, Speech Databases, Command and Control					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT		18. NUMBER OF PAGES
a. REPORT	b. ABSTRACT	c. THIS PAGE			19a. NAME OF RESPONSIBLE PERSON David T. Williamson
UNCLAS	UNCLAS	UNCLAS	UU		19b. TELEPHONE NUMBER (Include area code) (937) 255-7593

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EXECUTIVE SUMMARY

Automatic speech recognition holds the promise of providing a natural interface to computing systems. For the military, the realization of this natural interface will depend on a robust speech recognition technology that is capable of handling the degraded speech conditions typical of the military aircraft environment. To aid in the assessment of various commercially available speech recognition systems, several aircraft speech databases have been developed at the Air Force Research Laboratory's Human Effectiveness Directorate. These databases attempt to capture the degraded audio conditions typical in the military airborne environment. This report discusses the results of an extensive evaluation of the DynaSpeak v1.4.1 speech recognition system developed by Stanford Research Institute (SRI) using three different aircraft speech databases to benchmark its performance.

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INTRODUCTION

Speech technology holds the promise of providing a natural means for crewmembers to communicate with their onboard systems. Automatic speech recognition is a rapidly emerging human-computer interface technology that will provide a safe and efficient method for handling the complex information management requirements of future fighter aircraft. The Human Effectiveness Directorate in the Air Force Research Laboratory has been actively investigating the potential of this technology for over twenty years. Flight test experiments conducted in the 80's provided the first opportunity for AFRL to assess recognition performance of first generation airborne speech recognition systems [1] [2]. Results from these early flight test programs suggested that significant improvements in the area of robust speech recognition were needed before an operational system could be fielded in military aircraft.

Fortunately, significant progress has been made in robust speech recognition since those first flight test experiments in the 80's [3]. Improvements in the basic speech recognition algorithms and general purpose computing platforms are resulting in relatively inexpensive speech recognition systems that are designed to operate in noisy environments for command-and-control and data entry applications [4] [5]. With little modification, a system designed for these commercial applications could be adapted for use in military aircraft [6].

This paper discusses the results of an evaluation of release v1.4.1 of the SRI DynaSpeak system, a speech system targeted for use in PDAs and other embedded, small footprint applications. The DynaSpeak speech recognition system was tested using three aircraft speech databases developed by AFRL. These databases were the result of two flight test efforts with NASA Glenn Research Center on two different OV-10 aircraft and a flight test conducted at Edwards Air Force Base using an NF-16 (VISTA) aircraft. During each flight test, subjects spoke multiple test phrases in a variety of ground and in-flight conditions while an on-board speech recognition system attempted recognition. All spoken utterances were digitally recorded for later use in developing the databases.

OV-10A BOOM MICROPHONE DATABASE

Eleven active duty military and NASA pilots served as subjects during this flight test and were recorded for this database. The aircraft used for this experiment was an OV-10A aircraft (Figure 1) operated by NASA Glenn Research Center (GRC) in Cleveland, OH. This aircraft was a twin engine, two crewmember, tandem seating turboprop aircraft. The OV-10A was capable of pulling up to 5.5 gs, but due to equipment constraints the test profiles were limited to 1 and 3g maneuvers.

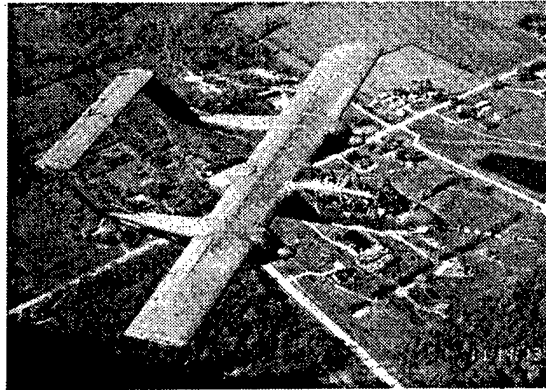


Figure 1. OV-10A Test Aircraft

Vocabulary/Test Prompts

The vocabulary consisted of 61 words and phrases that represent various tasks that could be accomplished in a military aircraft. The 61 vocabulary words and phrases were combined to form 91 test utterances to be used during ground and flight test conditions and are shown in Table 1. Synonymous words such as Go-to, Display, and Show or page and layer were designed into the test vocabulary to allow a more flexible interaction with the speech system.

Recording Procedures

Each subject was recorded in a variety of test conditions. The first condition was a baseline lab condition (Lab) which consisted of 91 unique utterances recited twice, resulting in the collection of 182 baseline speech samples. The test was conducted in a quiet pilot "ready room" with the subjects wearing their flight helmet outfitted with a standard military M-162 boom-mounted microphone interfaced with a custom designed microphone amplifier unit. The amplifier conditioned the audio signal to be compatible with the speech recognition system installed in a desktop computer system. All utterances were simultaneously recorded on 48 kHz digital audio tape (DAT) for later database development.

The subsequent data collection / recording sessions were conducted on the aircraft both on the ground with no engines running (Hangar condition) and in the air. During data collection in the aircraft, subjects sat in the rear seat of the OV-10A and were prompted with the same randomized set of 182 utterances to speak. All prompts appeared on a 5" x 7" monochromatic

liquid crystal display in the instrument panel directly in front of the subject. After completing the 182 utterance Hangar condition test, a NASA pilot, with the subjects in the back seat, flew the flight test profile consisting of three conditions: 1) straight and level flight (1G1), 2) 3g flight (3G), and 3) repetition of the 1g condition to examine potential fatigue effects (1G2). 182 utterances were spoken in each of the 1G1 and 1G2 conditions. In the 3G condition, the pilot climbed to altitude, typically between 12,000 and 15,000 feet above ground level (AGL), then put the aircraft into a spiral dive, maintaining a constant +3 Gs, while the subject in the back seat spoke the test phrases. Typically, 15 to 20 phrases could be spoken before the aircraft reached a safe floor of approximately 2000 feet AGL and had to climb back to altitude. The dive maneuver was repeatedly performed until 67 utterances were spoken to complete the 3G test condition.

Table 1. OV-10A Flight Test Prompts

add new nrp after 1 7	delete nrp 8 2	north 3 5 degrees 2 9 point 7 6 minutes
add new nrp after 2 6	delete nrp 9 9	north 5 7 degrees 1 0 point 2 7 minutes
add new nrp after 3 3	display comm	north 5 9 degrees 5 7 point 7 9 minutes
add new nrp after 3 8	display flight director layer	north 7 0 degrees 5 4 point 3 1 minutes
add new nrp after 5 1	display flight plan layer	north 7 3 degrees 4 2 point 0 6 minutes
add new nrp after 6 4	display ids layer	north 8 8 degrees 1 7 point 6 4 minutes
add new nrp before 1 3	display radar page	range 5
add new nrp before 2 2	east 1 3 degrees 0 0 point 8 4 minutes	range eighty
add new nrp before 2 6	east 2 3 degrees 3 2 point 4 8 minutes	range forty
add new nrp before 5 6	east 2 8 degrees 2 2 point 8 7 minutes	range one sixty
add new nrp before 8 2	east 3 4 degrees 2 8 point 5 9 minutes	range ten
add new nrp before 9 1	east 4 1 degrees 2 0 point 5 9 minutes	range twenty
change display to heading up	east 8 6 degrees 5 7 point 1 6 minutes	range two forty
change display to north up	give me beacon	show comm page
change display to sector up	give me ground map	show flight director page
change display to track up	give me pencil beam	show flight plan layer
change nrp 1 0	give me ta	show ids
change nrp 2 6	give me tf	show radar
change nrp 3 8	give me tfta	south 1 6 degrees 0 9 point 6 5 minutes
change nrp 4 4	give me weather	south 1 8 degrees 5 7 point 9 3 minutes
change nrp 9 7	go to comm layer	south 4 6 degrees 4 0 point 5 5 minutes
change radar mode to beacon	go to flight director	south 4 9 degrees 2 1 point 3 0 minutes
change radar mode to ground map	go to flight plan page	south 6 8 degrees 3 4 point 3 0 minutes
change radar mode to pencil beam	go to ids page	south 6 9 degrees 5 2 point 3 7 minutes
change radar mode to ta	go to radar layer	west 1 0 8 degrees 4 point 0 3 minutes
change radar mode to tf	modify nrp 0 8	west 1 2 degrees 3 4 point 1 1 minutes
change radar mode to tfta	modify nrp 2 1	west 3 8 degrees 2 9 point 4 5 minutes
change radar mode to weather	modify nrp 3 4	west 4 2 degrees 0 6 point 7 8 minutes
delete nrp 1 5	modify nrp 5 9	west 8 9 degrees 6 point 0 1 minutes
delete nrp 4 3	modify nrp 6 7	west 9 9 degrees 5 6 point 7 6 minutes
delete nrp 7 0		

All recordings were later digitally transferred to a personal computer system and down-sampled to produce 8 and 16 kHz sample sets. The resulting audio database is cleared for public release and is available to speech recognition researchers (Figure 2). Recordings and transcriptions from this database were reformatted to accommodate the DynaSpeak evaluation. Only the 8 kHz version of the database was used to test the system. To characterize the audio, signal to noise ratios for each subject and test condition were calculated and are presented in Table 2.

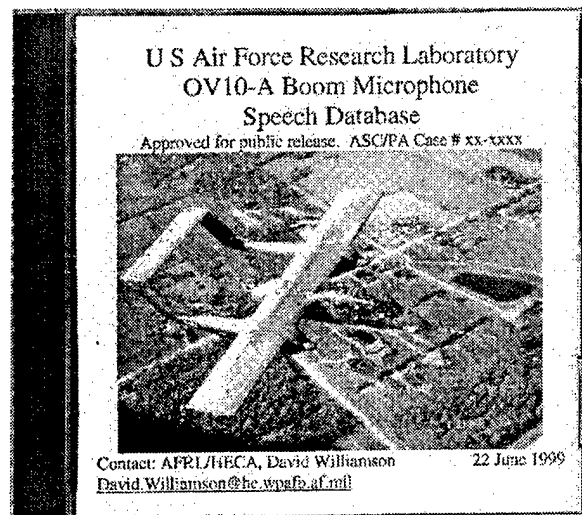


Figure 2. OV-10A Speech Database

Table 2. Signal to Noise Ratios for OV-10A 8 kHz Flight Test Recordings.

Subject	Lab	Hangar	lg1	3g	lg2	Mean
1	27.76	33.94	21.73	9.60	15.43	21.69
2	22.66	34.98	22.33	-3.24	15.13	18.37
3	23.72	29.68	19.33	8.90	18.46	20.02
4	24.62	26.24	12.21	3.92	11.35	15.67
5	17.73	20.04	11.32	8.28	7.88	13.05
6	29.61	36.29	21.01	11.73	21.03	23.93
7	17.42	16.68	10.37	-2.70	10.26	10.40
8	32.79	45.89	25.40	16.07	23.18	28.67
9	25.40	39.88	17.25	15.23	18.78	23.31
10	24.17	29.48	18.76	5.78	15.09	18.66
11	24.17	31.67	12.20	8.29	15.28	18.32
Mean	24.55	31.34	17.45	7.44	15.63	19.28

DynaSpeak OV-10A Evaluation Results

Appendix A shows the grammar file developed for the evaluation. The DynaSpeak system is supplied with several speaker models, two of which, Models-8khz and English-8K-030502, were used for this evaluation. Models-8khz is typically used as a general purpose model for 8 kHz speech, while the English-8K-030502 model is primarily used for well-enunciated speech. Several default DynaSpeak parameters were adjusted in the conduct of this evaluation. Of particular interest were the effects of speaker adaptation (MLLR), Dynamic Noise Compensation (DNC), Beamwidth and Word Transition Weight (WTW) parameters. Since past experiments showed significantly better performance with MLLR and DNC enabled, both of these features were enabled in this evaluation. The Beamwidth parameter was increased from the default 700

to 2000, and the Word Transition Weight parameter was varied using settings from -200 to +200 in increments of 50 for the evaluation. Word Transition Weight is used to balance the number of insertions versus the number of deletions in the recognition result. Figure 3 depicts the average Word Error Rates for each of the DynaSpeak Model and Word Transition Weight combinations tested.

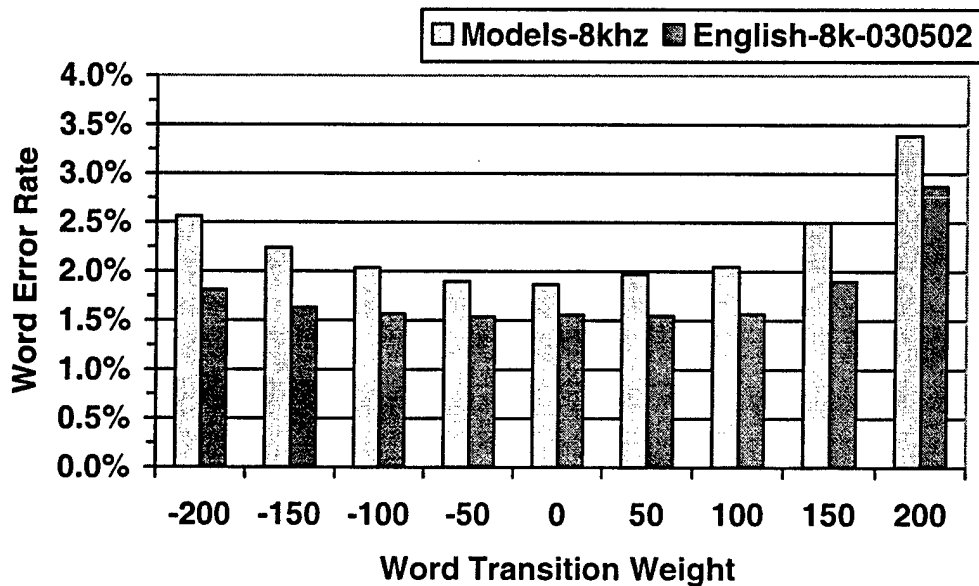


Figure 3. OV-10A Word Error Rate Results for Model and WTW combinations

Table 3 summarizes the 8 kHz word recognition performance of DynaSpeak's Models-8khz and English-8K-030502 models. Word recognition errors rates are presented for 48,141 words spoken by 11 test subjects over all test conditions and with Word Transition Weight parameter settings from -200 to +200 in increments of 50 units. The number of word errors for each condition is broken down by total Insertion, Deletion and Substitution errors. Specific error rates by flight condition and subject number can be found in Appendix B.

Table 3. DynaSpeak Word Recognition Performance for OV-10A Tests

Word Transition Weight	Models-8khz				English-8K-030502			
	Ins	Del	Sub	Word Error Rate	Ins	Del	Sub	Word Error Rate
-200	5	312	916	2.56%	5	104	760	1.81%
-150	8	208	862	2.24%	6	52	726	1.63%
-100	7	134	843	2.04%	7	33	718	1.57%
-50	10	76	831	1.90%	10	21	710	1.54%
0	16	52	830	1.87 %	12	15	726	1.56 %
50	27	45	874	1.97 %	19	9	716	1.55 %
100	40	30	917	2.05 %	26	11	721	1.57 %
150	64	40	1101	2.50%	41	28	845	1.90%
200	106	70	1454	3.39 %	68	64	1252	2.87 %

An Analysis of Variance (ANOVA) was conducted to determine if the overall Word Error Rates produced by either the two models or varying levels of Word Transition Weight were statistically different. No statistically significant differences were found for either Word Transition Weights ($F = 4.685$, $p < 0.116$) or Models ($F = 4.375$, $p < 0.063$). The combination of the English-8K-030502 model with the Word Transition Weight parameter set to -50 achieved the best recognition performance of 1.54% total Word Error Rate, with a bias toward deletion errors. Figure 4 details the recognition performance of this specific English-8K-030502 / WTW=-50 combination for each of the 5 flight test conditions. An ANOVA testing for statistically significant differences among the 5 flight conditions did reveal significant differences ($F = 12.857$, $p < 0.002$) in Word Error Rates. The average WER performance for the two ground test conditions, Lab and Hangar, was 0.65%. Average WER performance for the three flight conditions, 1G1, 3G, and 1G2, was 2.45%. Figure 5 contains additional detail by showing the variability among subjects for each of the flight conditions.

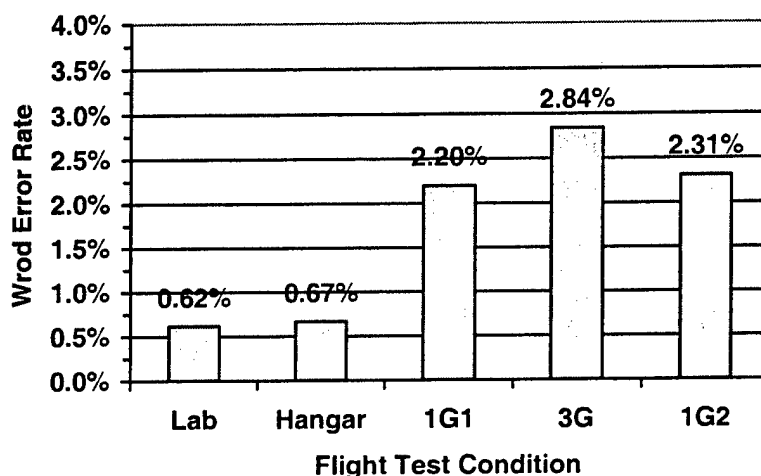


Figure 4. Results for English-8K-030502 Model, WTW=-50, by OV-10A Test Condition

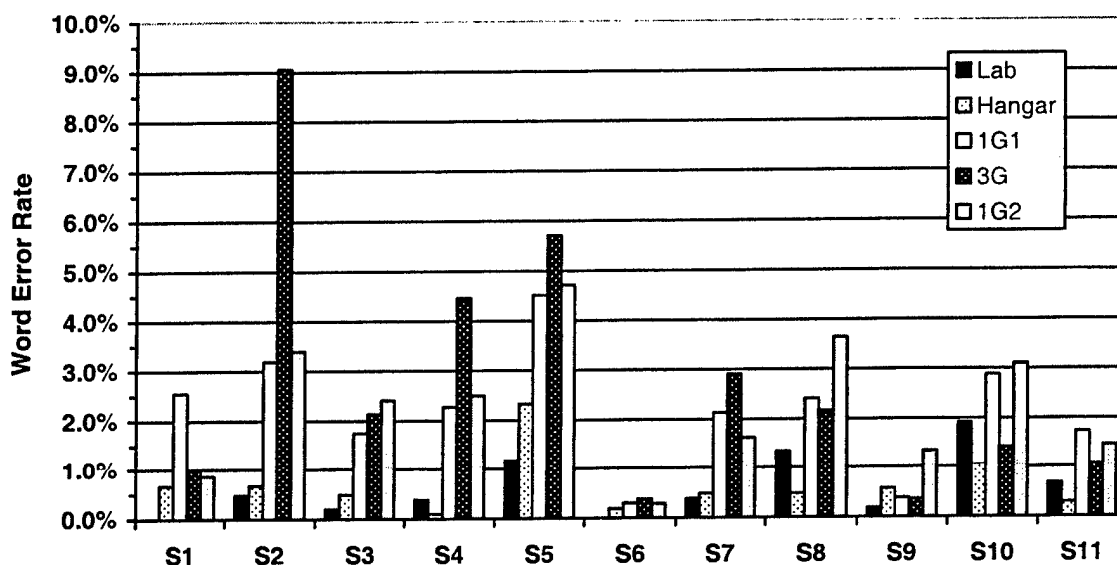


Figure 5. English-8K-030502 Model, WTW=-50, by OV-10A Test Condition and Subject

OV-10D OXYGEN MASK DATABASE

A second flight test was conducted, this time in an OV-10D model aircraft (Figure 6) operated by NASA Glenn Research Center. Like the OV-10A, this aircraft was a twin engine, two crewmember, tandem seating turboprop aircraft. The OV-10D was capable of pulling up to 5.5 gs, but test profiles were limited to 1 and 4g maneuvers. Subjects used an oxygen mask equipped with an Air Force standard M-169 microphone. This flight test was designed to examine the effects of aircraft noise, breath noise and gs on speech recognition performance. Twelve male subjects were recorded for this database. All were active duty military, contractor, or NASA personnel.

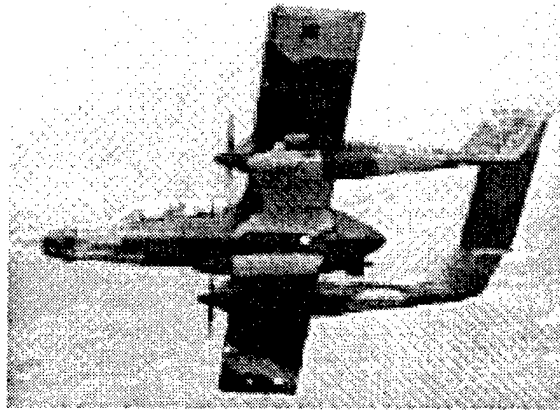


Figure 6. OV-10D Test Aircraft

Vocabulary/Test Prompts

A new vocabulary and grammar structure was developed for this experiment. The vocabulary consisted of 48 words or phrases, some of which were used during the second AFTI/F-16 flight test [2]. These words were used to create 52 unique test prompts (Table 4) used during ground and flight test conditions.

Recording Procedures

The recording procedures for collecting the database were repeated from the first OV-10A experiment. A test set of 57 prompts (the 52 unique prompts, plus the phrases air-to-air mode, air-to-ground mode, nav mode, ccip and strafe each repeated twice) was configured for all OV-10D test sessions. The first session (Lab) consisted of reciting the 57 utterances twice to collect a baseline recognition data set of 114 utterances. Once again, all of the test utterances were recorded on digital audio tape. The subsequent recording sessions were conducted onboard the NASA OV-10D aircraft both on the ground with no engines running, (Hangar) and in the air. After the 114 utterance ground test was complete, the subjects flew the flight test profile consisting of three conditions: 114 utterances at straight and level flight (1G1), a subset of 70 out of the 114 utterances in 4g flight (4G), and 114 utterances repeating the first 1g condition, but at a higher engine throttle setting to induce more background noise for this condition. (1G2). The 4G condition was a 1g increase compared with the OV-10A flight test.

Table 4. OV-10D Flight Test Prompts

air-to-air mode	ils runway 3 4 right	targeting-pod narrow
air-to-ground mode	nav mode	targeting-pod white-hot
ccip	radar 1 bar	targeting-pod wide
comm1 2 4 niner 8	radar 2 bar	tracker black-hot
comm1 3 6 8 5	radar 3 bar	tracker cursor-zero
comm1 button 7	radar 4 bar	tracker narrow
comm2 1 1 6 niner	radar azimuth sixty	tracker white-hot
comm2 1 5 0 6	radar azimuth ten	tracker wide
comm2 channel 4	radar azimuth thirty	uniform 2 7 8 4
hi-tacan runway 0 3 right	radar range eighty	uniform button 7
hi-tacan runway 0 6	radar range forty	uniform channel 5
hi-tacan runway 1 8 left	radar range ten	victor 1 3 4 5
hi-tacan runway 2 7 right	radar range twenty	victor button 6
hi-tacan runway 3 5 left	say fuel	victor channel niner
ils runway 0 7 right	say inventory	whats-my fuel
ils runway 0 niner left	strafe	whats-my inventory
ils runway 2 8 left	targeting-pod black-hot	
ils runway 2 niner	targeting-pod cursor-zero	

DynaSpeak OV-10D Evaluation Results

Once again, recordings were down-sampled to 8 kHz and transcriptions from this new database were reformatted to accommodate the DynaSpeak v1.4.1 evaluation. Signal to noise ratios for each subject and test condition were calculated and are presented in Table 5

Table 5. Signal to Noise Ratios for OV-10D 8 kHz Flight Test Recordings.

Subject	Lab	Hangar	lg1	4g	lg2	Mean
1	37.97	38.52	33.62	25.53	27.18	32.56
2	26.15	43.51	26.12	17.80	15.30	25.78
3	24.67	57.75	36.47	30.00	30.56	35.89
4	26.02	36.93	32.34	21.03	23.38	27.94
5	36.99	28.70	23.07	15.24	23.86	25.57
6	30.44	43.86	33.10	23.49	32.13	32.60
7	37.92	58.15	29.53	24.28	32.15	36.41
8	30.65	34.30	38.84	21.62	32.67	31.61
9	30.94	39.69	26.26	20.77	18.41	27.21
10	27.26	35.07	29.21	18.64	22.80	26.60
11	39.15	33.18	16.16	22.31	24.96	27.15
12	20.40	32.61	33.72	19.53	18.79	25.01
Mean	30.71	40.19	29.87	21.69	25.18	29.53

Appendix C shows the grammar file developed for the test. The same DynaSpeak parameter settings used in the OV-10A evaluation were again used. MLLR and DNC were enabled, the Beamwidth parameter was set to 2000, and the Word Transition Weight parameter was varied from -200 to +200 in unit increments of 50. Table 6 summarizes the 8 kHz word recognition performance of DynaSpeak's Models-8khz and English-8K-030502 models.

Table 6. DynaSpeak Word Recognition Performance for OV-10D Tests

Word Transition Weight	Models-8khz				English-8K-030502			
	Ins	Del	Sub	Word Error Rate	Ins	Del	Sub	Word Error Rate
-200	7	38	303	2.03%	5	36	168	1.22%
-150	6	31	297	1.95%	7	26	168	1.17%
-100	17	23	281	1.87%	9	15	170	1.13%
-50	25	17	305	2.02%	15	12	175	1.18%
0	53	9	324	2.25 %	18	12	182	1.24 %
50	92	5	340	2.55 %	26	10	198	1.36 %
100	176	2	423	3.50 %	71	8	279	2.09 %
150	309	4	578	5.19%	190	17	558	4.46%
200	673	15	962	9.62 %	434	95	1319	10.77 %

Word recognition errors rates are summarized for 17,153 words spoken by 12 test subjects over all test conditions and with the varying Word Transition Weight parameter settings. The number of word errors for each condition is broken down by total Insertion, Deletion and Substitution errors. Specific error rates by flight condition and subject number can be found in Appendix D.

When evaluating the DynaSpeak system using the OV-10D database, the best recognition performance, a total WER of 1.13 %, was achieved by using the English-8K-030502 model, but this time with the Word Transition Weight parameter set to -100. An Analysis of Variance indicated a statistically significant overall difference between the two Models ($F = 7.919$, $p < 0.017$) and also among the five flight conditions ($F = 5.252$, $p < 0.023$). Figure 7 details the recognition performance of the English-8K-030502 model / Word Transition Weight -100 combination for each of the 5 test conditions.

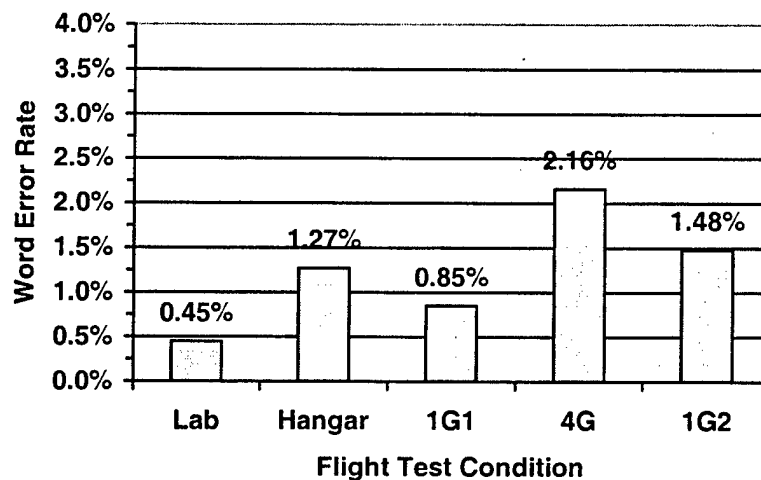


Figure 7. Results for English-8K-030502 Model, WTW=-100, by OV-10D Test Condition

The average WER performance for the two ground test conditions, Lab and Hangar, was 0.86%. Average WER performance for the three flight conditions, 1G1, 4G, and 1G2, was 1.5%.

Figure 8 shows additional detail by showing the results of this particular test broken down by both flight condition and subject.

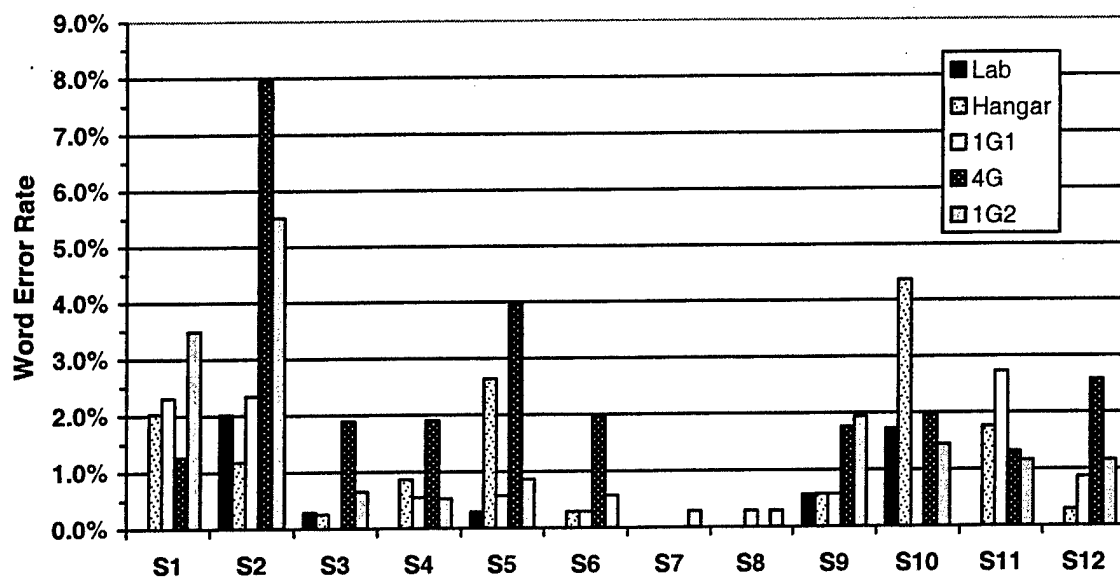


Figure 8. English-8K-030502 Model, WTW=-100, by OV-10D Test Condition and Subject

VISTA NF-16 DATABASE

A third flight test was conducted using the Air Force Research Laboratory's Variable stability In-flight Simulation Test Aircraft (VISTA). VISTA is a highly modified, two-seat F-16D (Figure 9), configured with Block 40 avionics, a production Digital Flight Control System, variable feel system, side controllers, and dual-bus architecture, allowing for both core avionics and simulation flight.

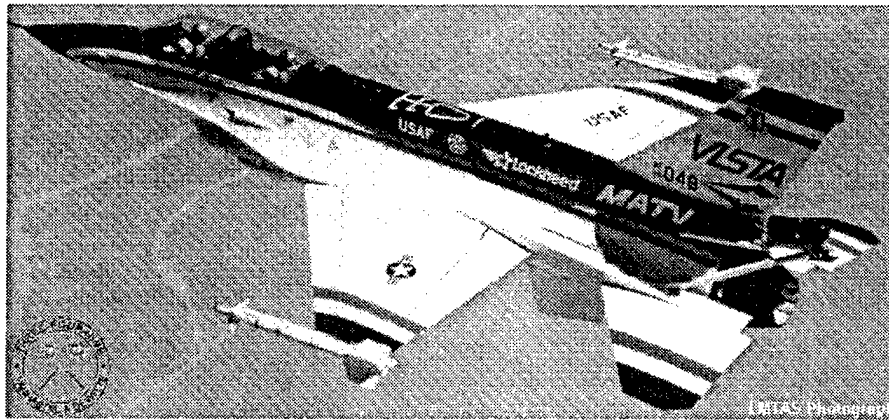


Figure 9. VISTA NF-16 Test Aircraft

Vocabulary/Test Prompts

The VISTA vocabulary consisted of 35 words. From these words, 74 test prompts were developed to be used during flight test conditions. The VISTA flight test prompts are shown in Table 7.

Table 7. VISTA Flight Test Prompts

declutter helmet	uniform two two nine three five enter	uniform three one zero enter
declutter hud	uniform two two nine six zero enter	uniform three one one eight seven enter
dogfight	uniform two two nine nine two enter	uniform three one two two seven enter
missile override	uniform two two nine nine zero enter	uniform three one nine one two enter
missile step	uniform two two nine nine five enter	uniform three two four two zero enter
nav mode	uniform two three one six seven enter	uniform three two five three zero enter
normal helmet	uniform two four one five five enter	uniform three three zero one enter
normal hud	uniform two five three eight five enter	uniform three three four four enter
sample background noise	uniform two six nine one five enter	uniform three three nine nine enter
say altitude	uniform two seven four eight two enter	uniform three four one enter
say calibrated airspeed	uniform two eight zero three seven enter	uniform three four three zero enter
say fuel	uniform two eight two seven zero enter	uniform three four four enter
say heading	uniform two eight three enter	uniform three four nine four enter
say mach	uniform two nine zero zero five enter	uniform three five zero two seven enter
say target info	uniform two nine two seven five enter	uniform three five one nine two enter
say true airspeed	uniform two nine three five seven enter	uniform three six two five enter
uniform two two five six zero enter	uniform two nine four seven seven enter	uniform three six four one seven enter
uniform two two five six two enter	uniform two nine seven seven two enter	uniform three six nine zero enter
uniform two two five nine enter	uniform two nine three one zero enter	uniform three seven six six seven enter
uniform two two six nine five enter	uniform two nine four five enter	uniform three eight three nine seven enter
uniform two two six nine seven enter	uniform two nine seven five two enter	uniform three eight four zero two enter
uniform two two eight three seven enter	uniform two nine eight eight five enter	uniform three eight seven seven zero enter
uniform two two eight three enter	uniform three zero two one five enter	uniform three nine zero nine two enter
uniform two two eight four zero enter	uniform three zero six six five enter	uniform three nine three six enter
uniform two two eight enter	uniform three zero seven four two enter	

Recording Procedures

A commercial off the shelf (COTS) speech recognition system was installed in the VISTA aircraft. The speaker-dependent system, a Verbex Speech Commander portable unit, was repackaged using a rugged enclosure with flight-worthy connectors and custom control head. This unit was mounted in the right side panel of the front cockpit to allow the front seat pilot to issue voice commands to the aircraft. As was done in the OV-10 flight test flights, all speech commands were recorded on digital audio tape.

Audio recordings were collected on 12 separate flights at Edwards Air Force Base, with both US and foreign test pilots serving as subjects. Each of these sorties was primarily scheduled as a test flight for a helmet-mounted display and programmable display system, but 10 to 15 minutes of each flight were dedicated to speech recognition system tasks. The recognition system was programmed to allow voice control of navigation master mode changes, missile mode changes, control of the helmet-mounted display formats, target information and verbal request and reporting of aircraft flight parameters such as current altitude, heading, airspeed and fuel quantity. Although the goal of each of these flights was to simply ensure that the system was working properly under varying noise and G-loading conditions, pilots quickly came to rely on the system's speech recognition and verbal feedback capabilities to provide information pertinent to other aspects of the flight test, and used the system throughout the sortie.

DynaSpeak VISTA Evaluation Results

All audio recordings from the 12 test flights were down-sampled to 8 kHz to create the VISTA speech database. Transcriptions were reformatted to accommodate the DynaSpeak v1.4.1 evaluation. Average Signal to Noise values were calculated for flight and are shown in Table 8.

Table 8. Signal to Noise Ratios for VISTA 8 kHz Flight Test Recordings

Flight Number												
	490	492	493	494	495	496	498	499	500	502	503	504
S/N	14.55	18.64	22.19	16.17	21.15	29.86	30.26	30.81	-2.27	21.20	15.39	31.94

Appendix E shows the grammar file developed for the VISTA test. As was done for the OV-10 flight tests, the DynaSpeak Beamwidth parameter was set to 2000, Word Transition Weight was varied from -200 to +200, and MLLR, DNC were active. Table 9 summarizes the 8 kHz word recognition performance of DynaSpeak's Models-8khz and English-8K-030502 models.

Word recognition errors rates are summarized for 17,153 words spoken by 12 test subjects over all test conditions and with varying Word Transition Weights. The number of word errors for each condition is broken down by total Insertion, Deletion and Substitution errors. An Analysis of Variance revealed no statistically significant differences between DynaSpeak Models or Word Transition Weights. Specific error rates by individual flight can be found in Appendix F. For this analysis, the best WER performance of 1.99% was found for the English-8K-030502 model when the Word Transition Weight parameter was set to -100. Figure 10 shows the results of this test condition broken down by individual flight.

Table 9. DynaSpeak Word Recognition Performance for VISTA Tests

Word Transition Weight	Models-8khz				English-8K-030502			
	Ins	Del	Sub	Word Error Rate	Ins	Del	Sub	Word Error Rate
-200	0	25	79	3.29%	1	17	61	2.50%
-150	1	21	73	3.00%	3	7	57	2.12%
-100	2	18	68	2.78%	4	6	53	1.99%
-50	1	12	61	2.34%	6	4	54	2.02%
0	2	9	62	2.31%	9	3	55	2.12%
50	8	5	61	2.34%	16	2	56	2.34%
100	12	4	53	2.18%	20	3	65	2.78%
150	17	3	76	3.04%	21	6	97	3.92%
200	25	4	141	5.38%	20	33	231	8.98%

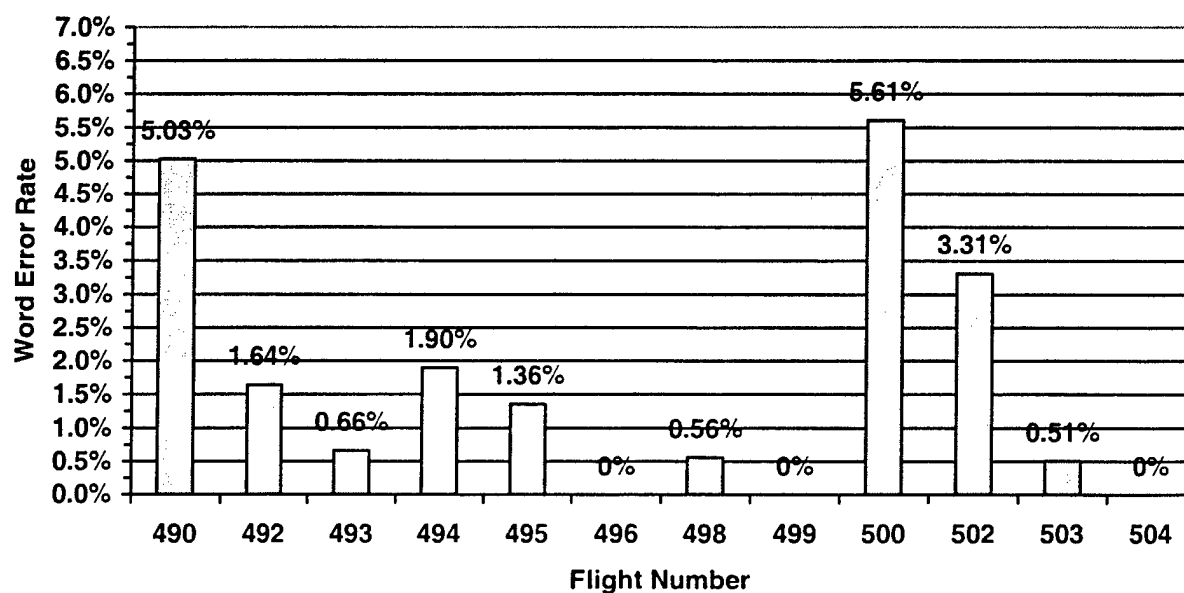


Figure 10. English-8K-030502 Model, WTW=-100, by Individual VISTA Flight

DISCUSSION

Each of the three databases used in this evaluation contain a mixture of good, clean audio with high signal to noise ratios and also very noisy, low signal to noise audio samples. The subjects performing the flight tests ranged from extremely experienced test pilots with many years of experience with the boom microphone, oxygen mask microphone and with pulling Gs, to rather novice flyers with no oxygen mask and G experience. A few of the test pilots in the VISTA flight tests were even non-native English speakers.

Regardless of the speaker experience and the relatively high noise in some of the audio samples, the DynaSpeak v1.4.1 speech recognition system performed surprisingly well. The English-8K-030502 acoustic models produced better overall recognition results than the generic Models-8khz models. Figures 11, 12, and 13 show the overall word recognition error rates obtained for each of the 3 flight test databases when using the English-8K-030502 acoustic model and manipulating the DynaSpeak Word Transition Weight parameter.

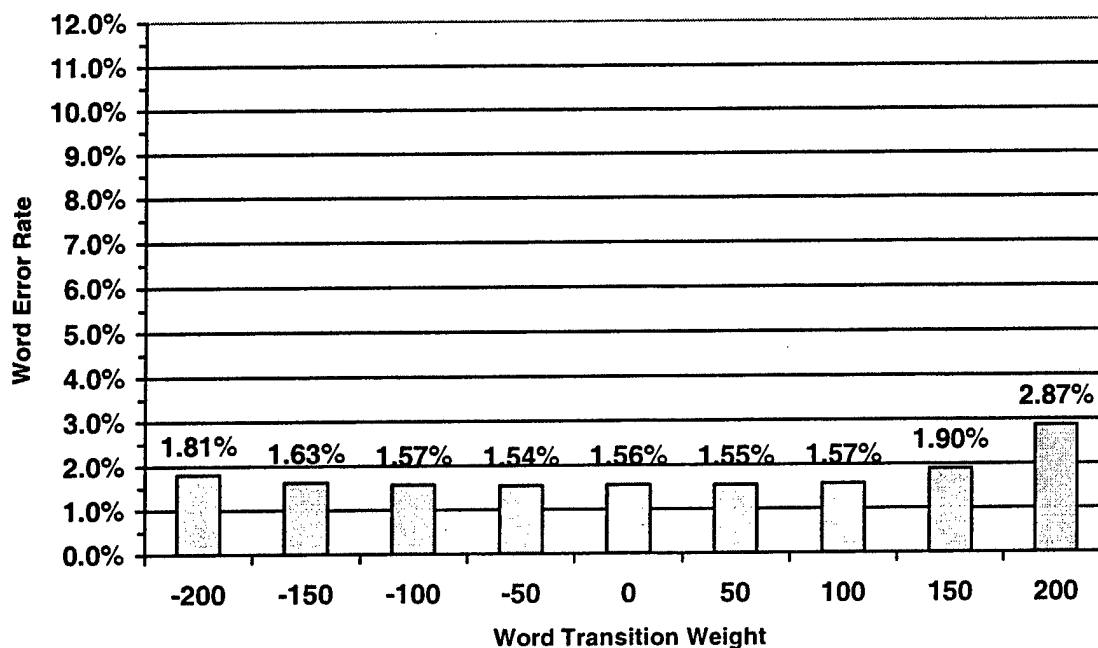


Figure 11. English-8K-030502 Acoustic Model Overall Word Recognition Error Rates for OV-10A Database by Word Transition Weight Parameter Setting

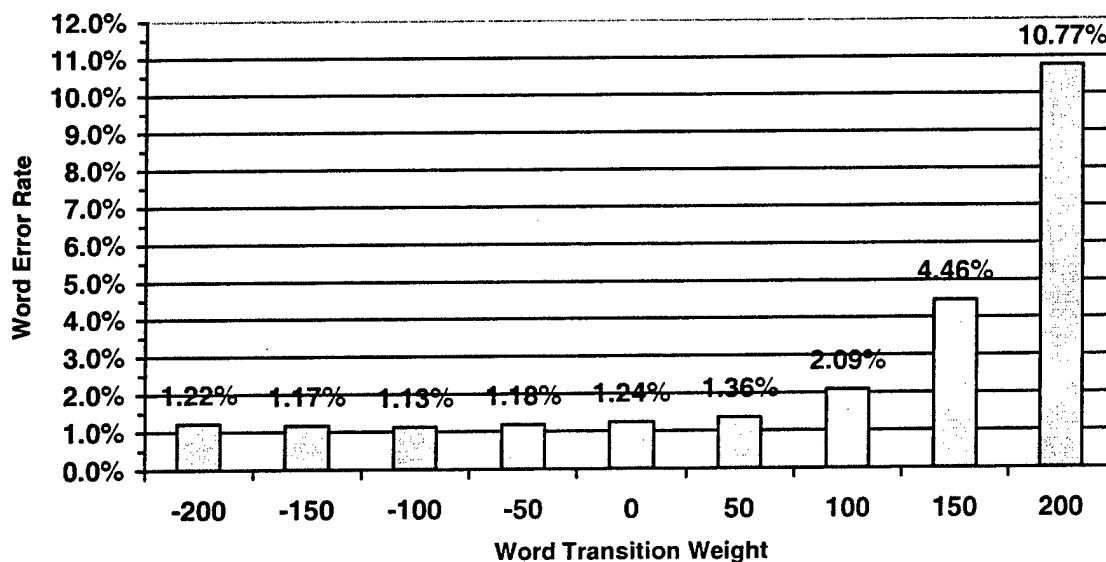


Figure 12. English-8K-030502 Acoustic Model Overall Word Recognition Error Rates for OV-10D Database by Word Transition Weight Parameter Setting

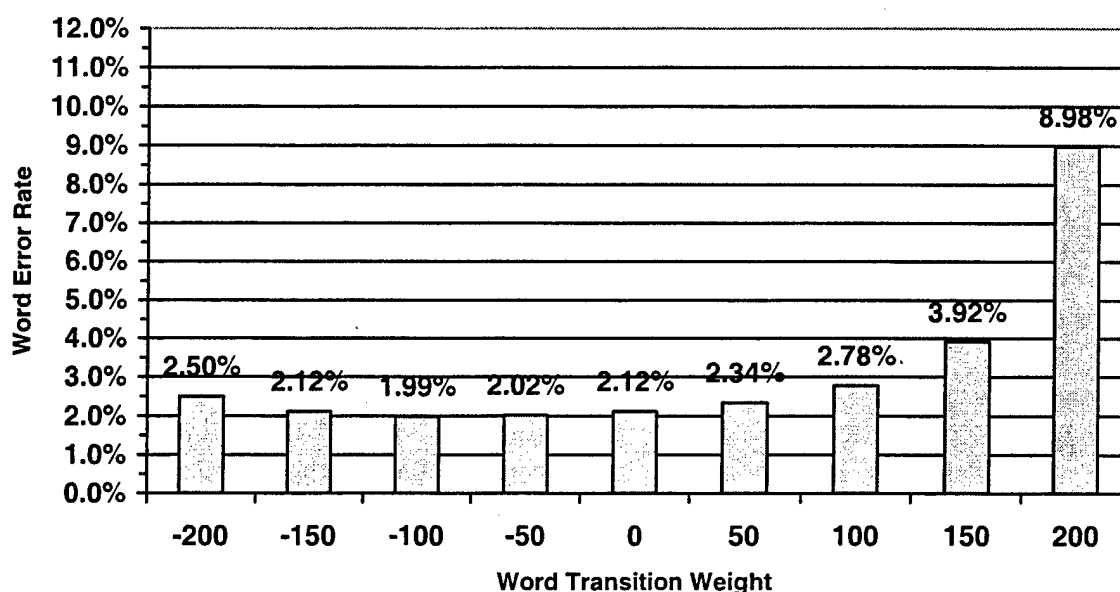


Figure 13. English-8K-030502 Acoustic Model Overall Word Recognition Error Rates for VISTA Database by Word Transition Weight Parameter Setting

The better performance obtained with the English-8K-030502 acoustic models over the generic Models-8khz model may be due to the fact that in all three flight tests, subjects were not speaking spontaneously. All were prompted to speak the test phrases, which usually results in better enunciated speech. The English-8K-030502 model is specifically tuned for clear enunciation.

These results highlight the critical importance in tuning speech systems to obtain optimum performance. Many times, default settings do not yield the best performance and only through controlled experimentation can the best combination of settings be derived for a given combination of grammar and operational conditions.

In general, the results of this evaluation were very encouraging and warrant further investigation. There are numerous applications where a small footprint, noise robust speech recognition system can be a significant enhancement to military systems. These applications range from data entry and retrieval for special tactics teams on the ground to single-seat fighter cockpit command and control. One of the goals of the speech research in the Human Effectiveness Directorate is to identify and exploit available speech technology to make the warfighter more effective and safe in accomplishing their mission. Speech systems like DynaSpeak may help achieve this goal.

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APPENDIX A: DYNASPEAK OV-10A GRAMMAR FILE

ta = t iy ey;
 tf = t iy eh f;
 tfta = t iy eh f t iy ey;
 ids = ay d iy eh s;
 comm = k aa m;
 nrp = eh n aa r p iy;

<Digit0_1> = zero | one;

<Digit0_5> = zero | one | two | three | four | five;

<Digit0_7> = zero | one | two | three | four | five | six | seven;

<Digit0_8> = zero | one | two | three | four | five | six | seven | eight;

<Digit0_9> = zero | one | two | three | four | five | six | seven | eight | nine;

<Before_After> = before | after;

<Del_Change_Mod> = delete | change | modify;

<Display_Mode> = (heading | north | sector | track) up;

<Radar_Mode> = beacon | (ground map) | (pencil beam) | ta | tf | tfta | weather;

<Display_Show_Goto> = display | show | (go to);

<Display_Format> = comm | (flight director) | (flight plan) | ids | radar;

<Page_Layer> = page | layer;

<Radar_Range> = five | ten | twenty | forty | eighty | (one sixty) | (two forty);

<North_South> = north | south;

<East_West> = east | west;

<Lat_Val> = (<Digit0_8> <Digit0_9> degrees [<Digit0_5>] <Digit0_9> point [<Digit0_9>] <Digit0_9> minutes);

<Lon_Val> = ((<Digit0_1> <Digit0_7> <Digit0_9> | <Digit0_9> <Digit0_9>) degrees [<Digit0_5>] <Digit0_9> point
 [<Digit0_9>] <Digit0_9> minutes);

<NRPCCommands> = (add new nrp <Before_After> <Digit0_9> <Digit0_9> |
 (<Del_Change_Mod> nrp <Digit0_9> <Digit0_9>);

<DisplayModeCommands> = (change display to) <Display_Mode>;

<RdrModeCommands> = ((change radar mode to) | (give me)) <Radar_Mode>;

<PageCommands> = <Display_Show_Goto> <Display_Format> [<Page_Layer>];

<RdrRangeCommands> = range <Radar_Range>;

<LatLonCommands> = <North_South> <Lat_Val> | <East_West> <Lon_Val>;

public <Command> = <NRPCCommands> | <DisplayModeCommands> | <RdrModeCommands> | <PageCommands>
 | <RdrRangeCommands> | <LatLonCommands>;

APPENDIX B:
OV-10A WORD ERROR RATES BY SUBJECT AND TEST CONDITION

models-8khz / WTW = -200

	INS	DEL	SUB	WORDS	WER	
LAB	1	13	60	11302	0.65%	0.9%
HANGAR	0	37	98	11183	1.21%	
1G1	0	45	290	11327	2.96%	4.0%
3G	3	115	145	2957	8.89%	
1G2	1	102	323	11372	3.75%	
Totals	5	312	916	48141	2.56%	

Subject	LAB	HANGAR	1G1	3G	1G2
1	0.00%	0.58%	3.44%	3.00%	2.99%
2	1.06%	0.77%	4.06%	42.39%	6.32%
3	0.79%	2.53%	4.47%	10.71%	5.68%
4	0.20%	0.19%	2.97%	5.95%	2.89%
5	1.68%	2.72%	4.13%	8.57%	4.43%
6	0.29%	0.87%	0.79%	3.01%	1.16%
7	0.29%	0.78%	2.42%	6.18%	3.76%
8	1.07%	1.16%	3.47%	3.99%	4.41%
9	0.10%	1.28%	1.35%	0.36%	1.95%
10	0.87%	0.88%	2.41%	7.86%	5.73%
11	0.88%	1.56%	3.00%	4.00%	1.87%

English-8K-030502 / WTW = -200

	INS	DEL	SUB	WORDS	WER	
LAB	1	8	67	11302	0.67%	0.7%
HANGAR	1	15	74	11183	0.80%	
1G1	0	9	248	11327	2.27%	2.7%
3G	2	39	97	2957	4.67%	
1G2	1	33	274	11372	2.71%	
Totals	5	104	760	48141	1.81%	

Subject	LAB	HANGAR	1G1	3G	1G2
1	0.00%	0.77%	2.65%	2.50%	1.35%
2	0.48%	0.67%	2.80%	18.12%	4.38%
3	0.29%	1.17%	2.04%	4.29%	2.60%
4	0.29%	0.10%	2.37%	4.83%	2.50%
5	1.88%	2.53%	4.32%	7.86%	5.30%
6	0.00%	0.58%	0.59%	0.00%	0.39%
7	0.29%	0.49%	1.84%	4.00%	2.50%
8	1.46%	0.48%	2.60%	2.90%	3.74%
9	0.10%	0.58%	0.48%	0.36%	1.66%
10	1.84%	1.07%	2.89%	3.93%	3.69%
11	0.78%	0.39%	2.32%	1.82%	1.67%

APPENDIX B (Continued)

models-8khz, WTW = -200

Subject 1

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	1028	0%	0%
HANGAR	0	1	5	1038	0.58%	1.65%
1G1	0	4	31	1017	3.44%	15.17%
3G	1	1	4	200	3%	10.42%
1G2	0	13	18	1038	2.99%	10.99%

Subject 2

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	1	10	1034	1.06%	5.52%
HANGAR	0	0	8	1038	0.77%	4.40%
1G1	0	3	39	1034	4.06%	19.89%
3G	1	59	57	276	42.39%	53.03%
1G2	1	18	46	1028	6.32%	22.78%

Subject 3

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	1	7	1017	0.79%	3.35%
HANGAR	0	8	18	1028	2.53%	10.50%
1G1	0	12	34	1028	4.47%	17.68%
3G	0	16	14	280	10.71%	19.40%
1G2	0	15	44	1038	5.68%	19.78%

Subject 4

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	2	1025	0.20%	1.11%
HANGAR	0	0	2	1038	0.19%	1.10%
1G1	0	2	28	1011	2.97%	14.69%
3G	0	5	11	269	5.95%	15.63%
1G2	0	1	29	1039	2.89%	13.74%

Subject 5

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	3	14	1010	1.68%	6.78%
HANGAR	0	10	18	1029	2.72%	9.44%
1G1	0	2	41	1042	4.13%	18.68%
3G	0	6	18	280	8.57%	22.39%
1G2	0	5	41	1038	4.43%	19.23%

Subject 6

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	2	1	1028	0.29%	1.66%
HANGAR	0	3	6	1033	0.87%	3.31%
1G1	0	2	6	1013	0.79%	3.35%
3G	0	4	4	266	3.01%	6.25%
1G2	0	6	6	1036	1.16%	5.49%

Subject 7

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	3	1032	0.29%	1.66%
HANGAR	0	4	4	1029	0.78%	4.44%
1G1	0	6	19	1035	2.42%	13.26%
3G	1	6	10	275	6.18%	10.61%
1G2	0	10	29	1038	3.76%	18.68%

Subject 8

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	4	7	1028	1.07%	5.56%
HANGAR	0	2	10	1033	1.16%	5.52%
1G1	0	0	36	1038	3.47%	15.93%
3G	0	3	8	276	3.99%	10.61%
1G2	0	3	43	1042	4.41%	18.23%

Subject 9

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	1038	0.10%	0.55%
HANGAR	0	3	8	861	1.28%	6.54%
1G1	0	6	8	1038	1.35%	3.85%
3G	0	0	1	280	0.36%	1.49%
1G2	0	4	16	1027	1.95%	9.94%

Subject 10

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	9	1034	0.87%	4.97%
HANGAR	0	0	9	1028	0.88%	4.42%
1G1	0	3	22	1038	2.41%	11.54%
3G	0	10	12	280	7.86%	14.93%
1G2	0	19	40	1030	5.73%	20.56%

Subject 11

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	2	6	1028	0.88%	3.87%
HANGAR	0	6	10	1028	1.56%	5.52%
1G1	0	5	26	1033	3%	12.71%
3G	0	5	6	275	4%	9.09%
1G2	0	8	11	1018	1.87%	6.11%

APPENDIX B (Continued)

English-8K-030502, WTW = -200

Subject 1

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	1028	0%	0%
HANGAR	1	1	6	1038	0.77%	3.30%
1G1	0	0	27	1017	2.65%	14.04%
3G	1	1	3	200	2.50%	8.33%
1G2	0	7	7	1038	1.35%	6.04%

Subject 2

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	5	1034	0.48%	2.76%
HANGAR	0	0	7	1038	0.67%	3.85%
1G1	0	0	29	1034	2.80%	14.92%
3G	0	21	29	276	18.12%	36.36%
1G2	1	10	34	1028	4.38%	18.33%

Subject 3

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	3	1017	0.29%	1.68%
HANGAR	0	4	8	1028	1.17%	5.52%
1G1	0	4	17	1028	2.04%	8.84%
3G	0	3	9	280	4.29%	14.93%
1G2	0	2	25	1038	2.60%	12.64%

Subject 4

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	3	1025	0.29%	1.67%
HANGAR	0	0	1	1038	0.10%	0.55%
1G1	0	0	24	1011	2.37%	12.99%
3G	0	3	10	269	4.83%	14.06%
1G2	0	0	26	1039	2.50%	13.74%

Subject 5

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	3	16	1010	1.88%	8.47%
HANGAR	0	5	21	1029	2.53%	12.22%
1G1	0	0	45	1042	4.32%	21.43%
3G	0	3	19	280	7.86%	22.39%
1G2	0	2	53	1038	5.30%	23.08%

Subject 6

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	1028	0%	0%
HANGAR	0	2	4	1033	0.58%	2.21%
1G1	0	2	4	1013	0.59%	2.79%
3G	0	0	0	266	0%	0%
1G2	0	1	3	1036	0.39%	2.20%

Subject 7

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	3	1032	0.29%	1.66%
HANGAR	0	0	5	1029	0.49%	2.78%
1G1	0	0	19	1035	1.84%	9.94%
3G	1	2	8	275	4%	9.09%
1G2	0	5	21	1038	2.50%	14.29%

Subject 8

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	3	12	1028	1.46%	7.22%
HANGAR	0	1	4	1033	0.48%	2.76%
1G1	0	0	27	1038	2.60%	13.19%
3G	0	1	7	276	2.90%	9.09%
1G2	0	0	39	1042	3.74%	18.78%

Subject 9

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	1038	0.10%	0.55%
HANGAR	0	1	4	861	0.58%	3.27%
1G1	0	0	5	1038	0.48%	2.75%
3G	0	0	1	280	0.36%	1.49%
1G2	0	1	16	1027	1.66%	8.29%

Subject 10

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	19	1034	1.84%	10.50%
HANGAR	0	0	11	1028	1.07%	6.08%
1G1	0	2	28	1038	2.89%	14.29%
3G	0	4	7	280	3.93%	10.45%
1G2	0	5	33	1030	3.69%	16.67%

Subject 11

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	2	5	1028	0.78%	3.31%
HANGAR	0	1	3	1028	0.39%	2.21%
1G1	0	1	23	1033	2.32%	11.60%
3G	0	1	4	275	1.82%	6.06%
1G2	0	0	17	1018	1.67%	9.44%

APPENDIX B (Continued)

models-8khz / WTW = -150

	INS	DEL	SUB	WORDS	WER	
LAB	1	11	57	11302	0.61%	0.8%
HANGAR	0	18	90	11183	0.97%	
1G1	1	28	287	11327	2.79%	3.5%
3G	4	99	127	2957	7.78%	
1G2	2	52	301	11372	3.12%	
Totals	8	208	862	48141	2.24%	

Subject	LAB	HANGAR	1G1	3G	1G2
1	0.00%	0.48%	3.54%	3.00%	2.41%
2	0.87%	0.48%	4.26%	37.32%	5.84%
3	0.79%	2.43%	3.60%	10.71%	4.05%
4	0.20%	0.19%	2.47%	5.58%	2.89%
5	1.58%	2.33%	3.93%	7.14%	4.05%
6	0.19%	0.48%	0.99%	2.63%	0.87%
7	0.29%	0.39%	2.22%	4.36%	3.08%
8	0.97%	0.87%	3.56%	3.26%	4.13%
9	0.10%	1.16%	0.77%	0.00%	1.46%
10	0.87%	0.88%	2.41%	7.14%	4.08%
11	0.88%	0.97%	2.90%	2.91%	1.47%

English-8K-030502 / WTW = -150

	INS	DEL	SUB	WORDS	WER	
LAB	1	6	64	11302	0.63%	0.7%
HANGAR	1	5	75	11183	0.72%	
1G1	2	6	240	11327	2.19%	2.5%
3G	1	21	80	2957	3.45%	
1G2	1	14	267	11372	2.48%	
Totals	6	52	726	48141	1.63%	

Subject	LAB	HANGAR	1G1	3G	1G2
1	0.00%	0.77%	2.46%	1.00%	0.67%
2	0.39%	0.67%	2.90%	10.87%	3.40%
3	0.29%	0.78%	1.95%	2.50%	2.60%
4	0.29%	0.10%	2.57%	4.83%	2.60%
5	1.49%	2.33%	4.51%	7.86%	5.39%
6	0.00%	0.39%	0.39%	0.00%	0.29%
7	0.29%	0.49%	1.93%	3.27%	2.12%
8	1.46%	0.48%	2.31%	2.90%	3.84%
9	0.19%	0.58%	0.29%	0.36%	1.36%
10	1.84%	1.07%	2.79%	2.50%	3.40%
11	0.68%	0.29%	1.94%	1.09%	1.57%

APPENDIX B (Continued)

models-8khz, WTW= -150

Subject 1

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	1028	0%	0%
HANGAR	0	1	4	1038	0.48%	1.65%
1G1	0	3	33	1017	3.54%	15.73%
3G	1	1	4	200	3%	10.42%
1G2	0	8	17	1038	2.41%	9.89%

Subject 2

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	1	8	1034	0.87%	4.42%
HANGAR	0	0	5	1038	0.48%	2.75%
1G1	1	3	40	1034	4.26%	20.44%
3G	2	53	48	276	37.32%	50%
1G2	2	11	47	1028	5.84%	21.11%

Subject 3

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	1	7	1017	0.79%	3.35%
HANGAR	0	7	18	1028	2.43%	9.94%
1G1	0	8	29	1028	3.60%	15.47%
3G	0	16	14	280	10.71%	19.40%
1G2	0	6	36	1038	4.05%	17.03%

Subject 4

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	2	1025	0.20%	1.11%
HANGAR	0	0	2	1038	0.19%	1.10%
1G1	0	0	25	1011	2.47%	12.99%
3G	0	5	10	269	5.58%	14.06%
1G2	0	1	29	1039	2.89%	13.74%

Subject 5

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	3	13	1010	1.58%	6.21%
HANGAR	0	5	19	1029	2.33%	9.44%
1G1	0	1	40	1042	3.93%	18.13%
3G	0	3	17	280	7.14%	20.90%
1G2	0	2	40	1038	4.05%	19.23%

Subject 6

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	1	1	1028	0.19%	1.10%
HANGAR	0	0	5	1033	0.48%	2.76%
1G1	0	1	9	1013	0.99%	4.47%
3G	0	3	4	266	2.63%	6.25%
1G2	0	4	5	1036	0.87%	4.95%

Subject 7

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	3	1032	0.29%	1.66%
HANGAR	0	1	3	1029	0.39%	2.22%
1G1	0	3	20	1035	2.22%	11.60%
3G	1	5	6	275	4.36%	6.06%
1G2	0	6	26	1038	3.08%	16.48%

Subject 8

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	3	7	1028	0.97%	5%
HANGAR	0	0	9	1033	0.87%	4.42%
1G1	0	0	37	1038	3.56%	16.48%
3G	0	2	7	276	3.26%	9.09%
1G2	0	2	41	1042	4.13%	17.13%

Subject 9

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	1038	0.10%	0.55%
HANGAR	0	2	8	861	1.16%	5.88%
1G1	0	1	7	1038	0.77%	2.75%
3G	0	0	0	280	0%	0%
1G2	0	2	13	1027	1.46%	7.18%

Subject 10

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	9	1034	0.87%	4.97%
HANGAR	0	0	9	1028	0.88%	4.42%
1G1	0	3	22	1038	2.41%	11.54%
3G	0	8	12	280	7.14%	16.42%
1G2	0	6	36	1030	4.08%	17.78%

Subject 11

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	2	6	1028	0.88%	3.87%
HANGAR	0	2	8	1028	0.97%	4.42%
1G1	0	5	25	1033	2.90%	12.15%
3G	0	3	5	275	2.91%	7.58%
1G2	0	4	11	1018	1.47%	5.56%

APPENDIX B (Continued)

English-8K-030502, WTW = -150

Subject 1

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	1028	0%	0%
HANGAR	1	0	7	1038	0.77%	3.30%
1G1	0	0	25	1017	2.46%	13.48%
3G	0	0	2	200	1%	4.17%
1G2	0	2	5	1038	0.67%	3.85%

Subject 2

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	4	1034	0.39%	2.21%
HANGAR	0	0	7	1038	0.67%	3.85%
1G1	0	0	30	1034	2.90%	14.92%
3G	0	11	19	276	10.87%	27.27%
1G2	1	4	30	1028	3.40%	14.44%

Subject 3

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	3	1017	0.29%	1.68%
HANGAR	0	1	7	1028	0.78%	3.87%
1G1	0	3	17	1028	1.95%	9.39%
3G	0	0	7	280	2.50%	10.45%
1G2	0	1	26	1038	2.60%	12.09%

Subject 4

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	3	1025	0.29%	1.67%
HANGAR	0	0	1	1038	0.10%	0.55%
1G1	1	1	24	1011	2.57%	13.56%
3G	0	3	10	269	4.83%	14.06%
1G2	0	0	27	1039	2.60%	13.74%

Subject 5

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	1	14	1010	1.49%	7.34%
HANGAR	0	3	21	1029	2.33%	11.11%
1G1	1	0	46	1042	4.51%	21.43%
3G	0	3	19	280	7.86%	23.88%
1G2	0	2	54	1038	5.39%	23.63%

Subject 6

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	1028	0%	0%
HANGAR	0	1	3	1033	0.39%	1.66%
1G1	0	1	3	1013	0.39%	2.23%
3G	0	0	0	266	0%	0%
1G2	0	0	3	1036	0.29%	1.65%

Subject 7

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	3	1032	0.29%	1.66%
HANGAR	0	0	5	1029	0.49%	2.78%
1G1	0	0	20	1035	1.93%	9.94%
3G	1	2	6	275	3.27%	7.58%
1G2	0	2	20	1038	2.12%	12.09%

Subject 8

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	3	12	1028	1.46%	7.22%
HANGAR	0	0	5	1033	0.48%	2.76%
1G1	0	0	24	1038	2.31%	12.64%
3G	0	1	7	276	2.90%	9.09%
1G2	0	0	40	1042	3.84%	19.34%

Subject 9

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	2	1038	0.19%	1.10%
HANGAR	0	0	5	861	0.58%	3.27%
1G1	0	0	3	1038	0.29%	1.65%
3G	0	0	1	280	0.36%	1.49%
1G2	0	0	14	1027	1.36%	7.18%

Subject 10

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	19	1034	1.84%	10.50%
HANGAR	0	0	11	1028	1.07%	6.08%
1G1	0	1	28	1038	2.79%	14.29%
3G	0	1	6	280	2.50%	8.96%
1G2	0	3	32	1030	3.40%	16.11%

Subject 11

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	2	4	1028	0.68%	2.76%
HANGAR	0	0	3	1028	0.29%	1.66%
1G1	0	0	20	1033	1.94%	9.94%
3G	0	0	3	275	1.09%	4.55%
1G2	0	0	16	1018	1.57%	8.33%

APPENDIX B (Continued)

models-8khz / WTW = -100

	INS	DEL	SUB	WORDS	WER	
LAB	1	6	54	11302	0.54%	0.7%
HANGAR	0	9	86	11183	0.85%	
1G1	1	15	283	11327	2.64%	3.2%
3G	3	70	108	2957	6.12%	
1G2	2	34	312	11372	3.06%	
Totals	7	134	843	48141	2.04%	

Subject	LAB	HANGAR	1G1	3G	1G2
1	0.10%	0.48%	3.15%	3.00%	2.70%
2	0.58%	0.77%	3.68%	32.61%	6.13%
3	0.69%	1.65%	3.50%	5.00%	4.05%
4	0.20%	0.10%	2.47%	4.83%	3.08%
5	1.39%	1.94%	3.84%	6.79%	4.14%
6	0.10%	0.48%	0.89%	3.01%	0.58%
7	0.19%	0.39%	2.22%	2.55%	2.99%
8	0.88%	0.97%	3.76%	2.90%	4.13%
9	0.10%	0.93%	0.67%	0.36%	1.36%
10	0.87%	0.68%	2.22%	2.86%	3.40%
11	0.88%	0.97%	2.61%	2.55%	1.08%

English-8K-030502 / WTW = -100

	INS	DEL	SUB	WORDS	WER	
LAB	1	3	66	11302	0.62%	0.7%
HANGAR	1	2	74	11183	0.69%	
1G1	2	5	244	11327	2.22%	2.4%
3G	2	17	73	2957	3.11%	
1G2	1	6	261	11372	2.36%	
Totals	7	33	718	48141	1.57%	

Subject	LAB	HANGAR	1G1	3G	1G2
1	0.00%	0.77%	2.56%	1.00%	0.77%
2	0.68%	0.67%	2.90%	11.23%	3.21%
3	0.10%	0.49%	1.85%	1.79%	2.60%
4	0.39%	0.10%	2.37%	4.46%	2.31%
5	1.29%	2.43%	4.61%	6.43%	5.20%
6	0.00%	0.19%	0.30%	0.00%	0.29%
7	0.29%	0.49%	1.93%	2.55%	1.83%
8	1.26%	0.48%	2.50%	2.17%	3.65%
9	0.19%	0.46%	0.39%	0.36%	1.46%
10	1.93%	1.07%	2.99%	2.50%	3.11%
11	0.68%	0.39%	1.94%	1.09%	1.47%

APPENDIX B (Continued)

models-8khz, WTW = -100

Subject 1

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	1028	0.10%	0.55%
HANGAR	0	1	4	1038	0.48%	1.65%
1G1	0	0	32	1017	3.15%	14.61%
3G	1	1	4	200	3%	10.42%
1G2	0	6	22	1038	2.70%	11.54%

Subject 2

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	6	1034	0.58%	3.31%
HANGAR	0	0	8	1038	0.77%	4.40%
1G1	1	0	37	1034	3.68%	18.78%
3G	1	44	45	276	32.61%	46.97%
1G2	2	8	53	1028	6.13%	21.67%

Subject 3

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	7	1017	0.69%	3.35%
HANGAR	0	2	15	1028	1.65%	8.29%
1G1	0	7	29	1028	3.50%	15.47%
3G	0	6	8	280	5%	13.43%
1G2	0	5	37	1038	4.05%	17.58%

Subject 4

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	2	1025	0.20%	1.11%
HANGAR	0	0	1	1038	0.10%	0.55%
1G1	0	0	25	1011	2.47%	12.99%
3G	0	4	9	269	4.83%	12.50%
1G2	0	1	31	1039	3.08%	14.84%

Subject 5

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	2	12	1010	1.39%	5.65%
HANGAR	0	3	17	1029	1.94%	7.78%
1G1	0	1	39	1042	3.84%	18.13%
3G	0	3	16	280	6.79%	19.40%
1G2	0	2	41	1038	4.14%	19.78%

Subject 6

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	1028	0.10%	0.55%
HANGAR	0	0	5	1033	0.48%	2.76%
1G1	0	0	9	1013	0.89%	4.47%
3G	0	3	5	266	3.01%	7.81%
1G2	0	3	3	1036	0.58%	3.30%

Subject 7

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	2	1032	0.19%	1.10%
HANGAR	0	1	3	1029	0.39%	2.22%
1G1	0	1	22	1035	2.22%	11.60%
3G	1	3	3	275	2.55%	4.55%
1G2	0	5	26	1038	2.99%	15.93%

Subject 8

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	2	7	1028	0.88%	4.44%
HANGAR	0	0	10	1033	0.97%	4.97%
1G1	0	0	39	1038	3.76%	17.03%
3G	0	2	6	276	2.90%	7.58%
1G2	0	2	41	1042	4.13%	17.13%

Subject 9

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	1038	0.10%	0.55%
HANGAR	0	0	8	861	0.93%	5.23%
1G1	0	1	6	1038	0.67%	2.75%
3G	0	0	1	280	0.36%	1.49%
1G2	0	1	13	1027	1.36%	7.73%

Subject 10

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	9	1034	0.87%	4.97%
HANGAR	0	0	7	1028	0.68%	3.31%
1G1	0	1	22	1038	2.22%	10.99%
3G	0	1	7	280	2.86%	10.45%
1G2	0	1	34	1030	3.40%	16.11%

Subject 11

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	2	6	1028	0.88%	3.87%
HANGAR	0	2	8	1028	0.97%	4.42%
1G1	0	4	23	1033	2.61%	11.05%
3G	0	3	4	275	2.55%	6.06%
1G2	0	0	11	1018	1.08%	5.56%

APPENDIX B (Continued)

English-8K-030502, WTW = -100

Subject 1

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	1028	0%	0%
HANGAR	1	0	7	1038	0.77%	3.30%
1G1	0	0	26	1017	2.56%	14.04%
3G	0	0	2	200	1%	4.17%
1G2	0	0	8	1038	0.77%	4.40%

Subject 2

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	7	1034	0.68%	3.87%
HANGAR	0	0	7	1038	0.67%	3.85%
1G1	0	0	30	1034	2.90%	14.92%
3G	1	11	19	276	11.23%	25.76%
1G2	1	3	29	1028	3.21%	14.44%

Subject 3

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	1017	0.10%	0.56%
HANGAR	0	0	5	1028	0.49%	2.76%
1G1	0	3	16	1028	1.85%	8.84%
3G	0	0	5	280	1.79%	7.46%
1G2	0	1	26	1038	2.60%	12.09%

Subject 4

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	4	1025	0.39%	2.22%
HANGAR	0	0	1	1038	0.10%	0.55%
1G1	1	1	22	1011	2.37%	12.43%
3G	0	2	10	269	4.46%	14.06%
1G2	0	0	24	1039	2.31%	12.64%

Subject 5

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	13	1010	1.29%	6.78%
HANGAR	0	2	23	1029	2.43%	12.22%
1G1	1	0	47	1042	4.61%	21.98%
3G	0	1	17	280	6.43%	20.90%
1G2	0	2	52	1038	5.20%	23.08%

Subject 6

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	1028	0%	0%
HANGAR	0	0	2	1033	0.19%	1.10%
1G1	0	0	3	1013	0.30%	1.68%
3G	0	0	0	266	0%	0%
1G2	0	0	3	1036	0.29%	1.65%

Subject 7

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	3	1032	0.29%	1.66%
HANGAR	0	0	5	1029	0.49%	2.78%
1G1	0	0	20	1035	1.93%	9.94%
3G	1	2	4	275	2.55%	4.55%
1G2	0	0	19	1038	1.83%	10.44%

Subject 8

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	1	12	1028	1.26%	6.11%
HANGAR	0	0	5	1033	0.48%	2.76%
1G1	0	0	26	1038	2.50%	13.19%
3G	0	0	6	276	2.17%	7.58%
1G2	0	0	38	1042	3.65%	18.23%

Subject 9

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	2	1038	0.19%	1.10%
HANGAR	0	0	4	861	0.46%	2.61%
1G1	0	0	4	1038	0.39%	2.20%
3G	0	0	1	280	0.36%	1.49%
1G2	0	0	15	1027	1.46%	7.73%

Subject 10

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	20	1034	1.93%	10.50%
HANGAR	0	0	11	1028	1.07%	6.08%
1G1	0	1	30	1038	2.99%	15.38%
3G	0	1	6	280	2.50%	8.96%
1G2	0	0	32	1030	3.11%	15.56%

Subject 11

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	2	4	1028	0.68%	2.76%
HANGAR	0	0	4	1028	0.39%	2.21%
1G1	0	0	20	1033	1.94%	9.94%
3G	0	0	3	275	1.09%	4.55%
1G2	0	0	15	1018	1.47%	7.78%

APPENDIX B (Continued)

models-8khz / WTW = -50

	INS	DEL	SUB	WORDS	WER	
LAB	1	4	53	11302	0.51%	0.6%
HANGAR	0	4	83	11183	0.78%	
1G1	1	10	284	11327	2.60%	3.0%
3G	3	39	91	2957	4.50%	
1G2	5	19	320	11372	3.02%	
Totals	10	76	831	48141	1.90%	

Subject	LAB	HANGAR	1G1	3G	1G2
1	0.00%	0.29%	3.15%	3.00%	2.60%
2	0.68%	0.77%	3.77%	23.55%	6.61%
3	0.59%	1.26%	3.21%	2.14%	3.95%
4	0.20%	0.10%	2.47%	4.83%	3.08%
5	1.29%	1.94%	3.93%	6.79%	3.95%
6	0.10%	0.48%	0.89%	1.50%	0.48%
7	0.19%	0.39%	1.93%	1.09%	3.18%
8	0.78%	0.87%	3.56%	2.17%	3.74%
9	0.10%	0.93%	0.58%	0.36%	1.36%
10	0.87%	0.78%	2.41%	2.86%	3.30%
11	0.88%	0.78%	2.71%	0.73%	0.98%

English-8K-030502 / WTW = -50

	INS	DEL	SUB	WORDS	WER	
LAB	1	3	66	11302	0.62%	0.6%
HANGAR	1	2	72	11183	0.67%	
1G1	3	4	242	11327	2.20%	2.3%
3G	3	9	72	2957	2.84%	
1G2	2	3	258	11372	2.31%	
Totals	10	21	710	48141	1.54%	

Subject	LAB	HANGAR	1G1	3G	1G2
1	0.00%	0.67%	2.56%	1.00%	0.87%
2	0.48%	0.67%	3.19%	9.06%	3.40%
3	0.20%	0.49%	1.75%	2.14%	2.41%
4	0.39%	0.10%	2.27%	4.46%	2.50%
5	1.19%	2.33%	4.51%	5.71%	4.72%
6	0.00%	0.19%	0.30%	0.38%	0.29%
7	0.39%	0.49%	2.13%	2.91%	1.64%
8	1.36%	0.48%	2.41%	2.17%	3.65%
9	0.19%	0.58%	0.39%	0.36%	1.36%
10	1.93%	1.07%	2.89%	1.43%	3.11%
11	0.68%	0.29%	1.74%	1.09%	1.47%

APPENDIX B (Continued)

models-8khz, WTW = -50

Subject 1

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	1028	0%	0%
HANGAR	0	0	3	1038	0.29%	1.65%
1G1	0	0	32	1017	3.15%	15.17%
3G	1	1	4	200	3%	10.42%
1G2	1	2	24	1038	2.60%	11.54%

Subject 2

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	7	1034	0.68%	3.87%
HANGAR	0	0	8	1038	0.77%	4.40%
1G1	1	0	38	1034	3.77%	19.89%
3G	1	28	36	276	23.55%	36.36%
1G2	4	7	57	1028	6.61%	23.33%

Subject 3

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	6	1017	0.59%	2.79%
HANGAR	0	0	13	1028	1.26%	7.18%
1G1	0	4	29	1028	3.21%	15.47%
3G	0	1	5	280	2.14%	7.46%
1G2	0	3	38	1038	3.95%	17.58%

Subject 4

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	2	1025	0.20%	1.11%
HANGAR	0	0	1	1038	0.10%	0.55%
1G1	0	0	25	1011	2.47%	12.99%
3G	0	4	9	269	4.83%	12.50%
1G2	0	1	31	1039	3.08%	14.84%

Subject 5

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	1	12	1010	1.29%	5.65%
HANGAR	0	3	17	1029	1.94%	7.78%
1G1	0	1	40	1042	3.93%	18.68%
3G	0	3	16	280	6.79%	20.90%
1G2	0	1	40	1038	3.95%	19.23%

Subject 6

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	1028	0.10%	0.55%
HANGAR	0	0	5	1033	0.48%	2.76%
1G1	0	0	9	1013	0.89%	4.47%
3G	0	0	4	266	1.50%	6.25%
1G2	0	0	5	1036	0.48%	2.75%

Subject 7

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	2	1032	0.19%	1.10%
HANGAR	0	0	4	1029	0.39%	2.22%
1G1	0	0	20	1035	1.93%	9.39%
3G	1	0	2	275	1.09%	3.03%
1G2	0	4	29	1038	3.18%	16.48%

Subject 8

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	1	7	1028	0.78%	3.89%
HANGAR	0	0	9	1033	0.87%	4.42%
1G1	0	0	37	1038	3.56%	15.93%
3G	0	1	5	276	2.17%	6.06%
1G2	0	0	39	1042	3.74%	16.02%

Subject 9

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	1038	0.10%	0.55%
HANGAR	0	0	8	861	0.93%	5.23%
1G1	0	0	6	1038	0.58%	2.20%
3G	0	0	1	280	0.36%	1.49%
1G2	0	1	13	1027	1.36%	7.73%

Subject 10

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	9	1034	0.87%	4.97%
HANGAR	0	0	8	1028	0.78%	3.87%
1G1	0	1	24	1038	2.41%	12.09%
3G	0	1	7	280	2.86%	10.45%
1G2	0	0	34	1030	3.30%	16.11%

Subject 11

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	2	6	1028	0.88%	3.87%
HANGAR	0	1	7	1028	0.78%	3.87%
1G1	0	4	24	1033	2.71%	11.60%
3G	0	0	2	275	0.73%	3.03%
1G2	0	0	10	1018	0.98%	5%

APPENDIX B (Continued)

English-8K-030502, WTW = -50

Subject 1

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	1028	0%	0%
HANGAR	1	0	6	1038	0.67%	2.75%
1G1	0	0	26	1017	2.56%	14.04%
3G	0	0	2	200	1%	4.17%
1G2	1	0	8	1038	0.87%	4.95%

Subject 2

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	5	1034	0.48%	2.76%
HANGAR	0	0	7	1038	0.67%	3.85%
1G1	1	0	32	1034	3.19%	16.02%
3G	2	5	18	276	9.06%	22.73%
1G2	1	3	31	1028	3.40%	14.44%

Subject 3

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	2	1017	0.20%	1.12%
HANGAR	0	0	5	1028	0.49%	2.76%
1G1	0	2	16	1028	1.75%	8.84%
3G	0	0	6	280	2.14%	8.96%
1G2	0	0	25	1038	2.41%	11.54%

Subject 4

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	4	1025	0.39%	2.22%
HANGAR	0	0	1	1038	0.10%	0.55%
1G1	1	1	21	1011	2.27%	11.86%
3G	0	2	10	269	4.46%	14.06%
1G2	0	0	26	1039	2.50%	13.74%

Subject 5

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	12	1010	1.19%	6.21%
HANGAR	0	2	22	1029	2.33%	11.67%
1G1	1	0	46	1042	4.51%	21.43%
3G	0	0	16	280	5.71%	19.40%
1G2	0	0	49	1038	4.72%	21.98%

Subject 6

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	1028	0%	0%
HANGAR	0	0	2	1033	0.19%	1.10%
1G1	0	0	3	1013	0.30%	1.68%
3G	0	0	1	266	0.38%	1.56%
1G2	0	0	3	1036	0.29%	1.65%

Subject 7

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	4	1032	0.39%	2.21%
HANGAR	0	0	5	1029	0.49%	2.78%
1G1	0	0	22	1035	2.13%	11.05%
3G	1	2	5	275	2.91%	6.06%
1G2	0	0	17	1038	1.64%	9.34%

Subject 8

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	1	13	1028	1.36%	6.67%
HANGAR	0	0	5	1033	0.48%	2.76%
1G1	0	0	25	1038	2.41%	12.09%
3G	0	0	6	276	2.17%	7.58%
1G2	0	0	38	1042	3.65%	18.23%

Subject 9

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	2	1038	0.19%	1.10%
HANGAR	0	0	5	861	0.58%	3.27%
1G1	0	0	4	1038	0.39%	2.20%
3G	0	0	1	280	0.36%	1.49%
1G2	0	0	14	1027	1.36%	7.18%

Subject 10

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	20	1034	1.93%	10.50%
HANGAR	0	0	11	1028	1.07%	6.08%
1G1	0	1	29	1038	2.89%	14.84%
3G	0	0	4	280	1.43%	5.97%
1G2	0	0	32	1030	3.11%	15.56%

Subject 11

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	2	4	1028	0.68%	2.76%
HANGAR	0	0	3	1028	0.29%	1.66%
1G1	0	0	18	1033	1.74%	8.84%
3G	0	0	3	275	1.09%	4.55%
1G2	0	0	15	1018	1.47%	7.78%

APPENDIX B (Continued)

models-8khz / WTW = 0

	INS	DEL	SUB	WORDS	WER	
LAB	1	2	53	11302	0.50%	0.6%
HANGAR	0	2	81	11183	0.74%	
1G1	2	9	283	11327	2.60%	3.0%
3G	4	30	88	2957	4.13%	
1G2	9	9	325	11372	3.02%	
Totals	16	52	830	48141	1.87%	

Subject	LAB	HANGAR	1G1	3G	1G2
1	0.00%	0.29%	3.15%	3.00%	2.99%
2	0.58%	0.67%	3.77%	23.91%	6.32%
3	0.59%	1.36%	3.21%	2.50%	3.56%
4	0.20%	0.19%	2.18%	3.72%	2.98%
5	1.29%	1.65%	4.22%	4.29%	3.76%
6	0.10%	0.48%	0.89%	1.50%	0.48%
7	0.19%	0.29%	2.13%	1.45%	3.37%
8	0.68%	0.97%	3.47%	1.45%	4.03%
9	0.10%	0.93%	0.48%	0.36%	1.36%
10	0.87%	0.78%	2.31%	2.14%	3.30%
11	0.88%	0.58%	2.71%	0.73%	0.98%

English-8K-030502 / WTW = 0

	INS	DEL	SUB	WORDS	WER	
LAB	1	3	66	11302	0.62%	0.6%
HANGAR	1	1	71	11183	0.65%	
1G1	3	3	241	11327	2.18%	2.4%
3G	4	8	72	2957	2.84%	
1G2	3	0	276	11372	2.45%	
Totals	12	15	726	48141	1.56%	

Subject	LAB	HANGAR	1G1	3G	1G2
1	0.00%	0.77%	2.56%	1.00%	1.06%
2	0.68%	0.77%	2.90%	9.06%	3.40%
3	0.20%	0.49%	1.56%	2.50%	2.70%
4	0.39%	0.10%	2.47%	4.46%	2.79%
5	1.39%	1.85%	4.51%	5.71%	4.91%
6	0.00%	0.19%	0.30%	0.38%	0.29%
7	0.29%	0.49%	2.22%	3.27%	2.12%
8	1.17%	0.48%	2.31%	1.81%	3.74%
9	0.19%	0.58%	0.29%	0.36%	1.36%
10	1.84%	1.17%	2.89%	1.43%	3.20%
11	0.68%	0.29%	1.94%	0.73%	1.38%

APPENDIX B (Continued)

models-8khz, WTW=0

Subject 1

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	1028	0%	0%
HANGAR	0	0	3	1038	0.29%	1.65%
1G1	0	0	32	1017	3.15%	14.61%
3G	1	1	4	200	3%	10.42%
1G2	1	2	28	1038	2.99%	13.74%

Subject 2

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	6	1034	0.58%	3.31%
HANGAR	0	0	7	1038	0.67%	3.85%
1G1	1	0	38	1034	3.77%	19.34%
3G	2	24	40	276	23.91%	39.39%
1G2	6	3	56	1028	6.32%	23.89%

Subject 3

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	6	1017	0.59%	2.79%
HANGAR	0	0	14	1028	1.36%	7.73%
1G1	1	3	29	1028	3.21%	15.47%
3G	0	1	6	280	2.50%	8.96%
1G2	0	0	37	1038	3.56%	15.93%

Subject 4

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	2	1025	0.20%	1.11%
HANGAR	0	0	2	1038	0.19%	1.10%
1G1	0	0	22	1011	2.18%	11.30%
3G	0	3	7	269	3.72%	9.38%
1G2	0	1	30	1039	2.98%	14.84%

Subject 5

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	13	1010	1.29%	5.65%
HANGAR	0	2	15	1029	1.65%	6.67%
1G1	0	1	43	1042	4.22%	19.78%
3G	0	0	12	280	4.29%	14.93%
1G2	0	0	39	1038	3.76%	18.13%

Subject 6

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	1028	0.10%	0.55%
HANGAR	0	0	5	1033	0.48%	2.76%
1G1	0	0	9	1013	0.89%	5.03%
3G	0	0	4	266	1.50%	6.25%
1G2	0	0	5	1036	0.48%	2.75%

Subject 7

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	2	1032	0.19%	1.10%
HANGAR	0	0	3	1029	0.29%	1.67%
1G1	0	0	22	1035	2.13%	10.50%
3G	1	0	3	275	1.45%	4.55%
1G2	1	2	32	1038	3.37%	16.48%

Subject 8

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	7	1028	0.68%	3.89%
HANGAR	0	0	10	1033	0.97%	4.97%
1G1	0	0	36	1038	3.47%	16.48%
3G	0	0	4	276	1.45%	4.55%
1G2	1	0	41	1042	4.03%	17.13%

Subject 9

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	1038	0.10%	0.55%
HANGAR	0	0	8	861	0.93%	5.23%
1G1	0	0	5	1038	0.48%	2.20%
3G	0	0	1	280	0.36%	1.49%
1G2	0	1	13	1027	1.36%	7.73%

Subject 10

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	9	1034	0.87%	4.97%
HANGAR	0	0	8	1028	0.78%	3.87%
1G1	0	1	23	1038	2.31%	11.54%
3G	0	1	5	280	2.14%	7.46%
1G2	0	0	34	1030	3.30%	16.11%

Subject 11

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	2	6	1028	0.88%	3.87%
HANGAR	0	0	6	1028	0.58%	3.31%
1G1	0	4	24	1033	2.71%	11.60%
3G	0	0	2	275	0.73%	3.03%
1G2	0	0	10	1018	0.98%	5%

APPENDIX B (Continued)

English-8K-030502, WTW=0

Subject 1

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	1028	0%	0%
HANGAR	1	0	7	1038	0.77%	3.30%
1G1	0	0	26	1017	2.56%	13.48%
3G	0	0	2	200	1%	4.17%
1G2	1	0	10	1038	1.06%	6.04%

Subject 2

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	7	1034	0.68%	3.87%
HANGAR	0	0	8	1038	0.77%	4.40%
1G1	1	0	29	1034	2.90%	14.92%
3G	2	5	18	276	9.06%	22.73%
1G2	1	0	34	1028	3.40%	15.56%

Subject 3

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	2	1017	0.20%	1.12%
HANGAR	0	0	5	1028	0.49%	2.76%
1G1	0	1	15	1028	1.56%	8.29%
3G	0	0	7	280	2.50%	10.45%
1G2	0	0	28	1038	2.70%	13.19%

Subject 4

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	4	1025	0.39%	2.22%
HANGAR	0	0	1	1038	0.10%	0.55%
1G1	1	1	23	1011	2.47%	12.99%
3G	0	2	10	269	4.46%	14.06%
1G2	0	0	29	1039	2.79%	14.84%

Subject 5

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	14	1010	1.39%	6.78%
HANGAR	0	1	18	1029	1.85%	9.44%
1G1	1	0	46	1042	4.51%	21.43%
3G	1	0	15	280	5.71%	20.90%
1G2	0	0	51	1038	4.91%	22.53%

Subject 6

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	1028	0%	0%
HANGAR	0	0	2	1033	0.19%	1.10%
1G1	0	0	3	1013	0.30%	1.68%
3G	0	0	1	266	0.38%	1.56%
1G2	0	0	3	1036	0.29%	1.65%

Subject 7

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	3	1032	0.29%	1.66%
HANGAR	0	0	5	1029	0.49%	2.78%
1G1	0	0	23	1035	2.22%	11.60%
3G	1	1	7	275	3.27%	7.58%
1G2	1	0	21	1038	2.12%	11.54%

Subject 8

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	1	11	1028	1.17%	6.11%
HANGAR	0	0	5	1033	0.48%	2.76%
1G1	0	0	24	1038	2.31%	12.64%
3G	0	0	5	276	1.81%	6.06%
1G2	0	0	39	1042	3.74%	18.23%

Subject 9

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	2	1038	0.19%	1.10%
HANGAR	0	0	5	861	0.58%	3.27%
1G1	0	0	3	1038	0.29%	1.65%
3G	0	0	1	280	0.36%	1.49%
1G2	0	0	14	1027	1.36%	7.73%

Subject 10

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	19	1034	1.84%	10.50%
HANGAR	0	0	12	1028	1.17%	6.63%
1G1	0	1	29	1038	2.89%	14.84%
3G	0	0	4	280	1.43%	5.97%
1G2	0	0	33	1030	3.20%	15.56%

Subject 11

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	2	4	1028	0.68%	2.76%
HANGAR	0	0	3	1028	0.29%	1.66%
1G1	0	0	20	1033	1.94%	9.94%
3G	0	0	2	275	0.73%	3.03%
1G2	0	0	14	1018	1.38%	7.22%

APPENDIX B (Continued)

models-8khz / WTW = 50

	INS	DEL	SUB	WORDS	WER	
LAB	1	2	54	11302	0.50%	0.6%
HANGAR	3	1	82	11183	0.77%	
1G1	4	5	292	11327	2.66%	3.1%
3G	8	29	101	2957	4.67%	
1G2	11	8	345	11372	3.20%	
Totals	27	45	874	48141	1.97%	

Subject	LAB	HANGAR	1G1	3G	1G2
1	0.00%	0.39%	3.15%	3.00%	3.28%
2	0.68%	0.58%	3.77%	26.09%	7.39%
3	0.69%	1.46%	3.21%	3.21%	3.66%
4	0.20%	0.19%	2.27%	4.09%	2.98%
5	1.09%	1.75%	4.13%	3.93%	3.95%
6	0.10%	0.68%	0.79%	1.50%	0.48%
7	0.19%	0.29%	2.90%	2.91%	3.56%
8	0.78%	0.97%	3.66%	1.45%	4.03%
9	0.10%	0.93%	0.67%	0.36%	1.36%
10	0.87%	0.68%	2.31%	3.57%	3.40%
11	0.88%	0.58%	2.32%	0.73%	1.08%

English-8K-030502 / WTW = 50

	INS	DEL	SUB	WORDS	WER	
LAB	2	2	63	11302	0.59%	0.6%
HANGAR	2	1	66	11183	0.62%	
1G1	4	1	242	11327	2.18%	2.4%
3G	5	5	76	2957	2.91%	
1G2	6	0	269	11372	2.42%	
Totals	19	9	716	48141	1.55%	

Subject	LAB	HANGAR	1G1	3G	1G2
1	0.00%	0.58%	2.36%	2.00%	1.35%
2	0.48%	0.77%	2.80%	9.78%	3.60%
3	0.29%	0.49%	1.26%	2.50%	2.79%
4	0.29%	0.10%	2.37%	2.23%	2.41%
5	1.09%	1.65%	4.80%	6.07%	4.62%
6	0.10%	0.19%	0.30%	0.75%	0.29%
7	0.29%	0.49%	2.42%	3.27%	1.83%
8	1.26%	0.48%	2.50%	2.17%	3.65%
9	0.19%	0.46%	0.58%	0.36%	1.46%
10	1.84%	1.17%	2.50%	1.79%	3.30%
11	0.68%	0.39%	2.03%	0.73%	1.28%

APPENDIX B (Continued)

models-8khz, WTW=50

Subject 1

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	1028	0%	0%
HANGAR	1	0	3	1038	0.39%	2.20%
1G1	0	0	32	1017	3.15%	14.61%
3G	1	1	4	200	3%	10.42%
1G2	2	2	30	1038	3.28%	14.84%

Subject 2

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	7	1034	0.68%	3.87%
HANGAR	0	0	6	1038	0.58%	3.30%
1G1	1	0	38	1034	3.77%	18.78%
3G	4	23	45	276	26.09%	45.45%
1G2	6	5	65	1028	7.39%	26.11%

Subject 3

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	7	1017	0.69%	3.35%
HANGAR	0	0	15	1028	1.46%	8.29%
1G1	2	2	29	1028	3.21%	15.47%
3G	1	0	8	280	3.21%	11.94%
1G2	1	0	37	1038	3.66%	16.48%

Subject 4

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	2	1025	0.20%	1.11%
HANGAR	0	0	2	1038	0.19%	1.10%
1G1	0	0	23	1011	2.27%	11.86%
3G	0	3	8	269	4.09%	10.94%
1G2	0	1	30	1039	2.98%	14.29%

Subject 5

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	11	1010	1.09%	5.08%
HANGAR	2	1	15	1029	1.75%	7.22%
1G1	0	1	42	1042	4.13%	19.23%
3G	0	0	11	280	3.93%	16.42%
1G2	0	0	41	1038	3.95%	19.23%

Subject 6

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	1028	0.10%	0.55%
HANGAR	0	0	7	1033	0.68%	3.31%
1G1	0	0	8	1013	0.79%	4.47%
3G	0	0	4	266	1.50%	6.25%
1G2	0	0	5	1036	0.48%	2.75%

Subject 7

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	2	1032	0.19%	1.10%
HANGAR	0	0	3	1029	0.29%	1.67%
1G1	1	0	29	1035	2.90%	13.26%
3G	1	1	6	275	2.91%	6.06%
1G2	1	0	36	1038	3.56%	17.58%

Subject 8

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	8	1028	0.78%	4.44%
HANGAR	0	0	10	1033	0.97%	4.97%
1G1	0	0	38	1038	3.66%	17.03%
3G	0	0	4	276	1.45%	4.55%
1G2	1	0	41	1042	4.03%	17.13%

Subject 9

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	1038	0.10%	0.55%
HANGAR	0	0	8	861	0.93%	5.23%
1G1	0	0	7	1038	0.67%	3.30%
3G	0	0	1	280	0.36%	1.49%
1G2	0	0	14	1027	1.36%	7.73%

Subject 10

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	9	1034	0.87%	4.97%
HANGAR	0	0	7	1028	0.68%	3.31%
1G1	0	1	23	1038	2.31%	11.54%
3G	1	1	8	280	3.57%	10.45%
1G2	0	0	35	1030	3.40%	16.11%

Subject 11

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	2	6	1028	0.88%	3.87%
HANGAR	0	0	6	1028	0.58%	3.31%
1G1	0	1	23	1033	2.32%	11.05%
3G	0	0	2	275	0.73%	3.03%
1G2	0	0	11	1018	1.08%	5.56%

APPENDIX B (Continued)

English-8K-030502, WTW=50

Subject 1

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	1028	0%	0%
HANGAR	1	0	5	1038	0.58%	2.20%
1G1	0	0	24	1017	2.36%	12.92%
3G	0	0	4	200	2%	6.25%
1G2	2	0	12	1038	1.35%	7.14%

Subject 2

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	5	1034	0.48%	2.76%
HANGAR	0	0	8	1038	0.77%	4.40%
1G1	1	0	28	1034	2.80%	14.36%
3G	3	4	20	276	9.78%	24.24%
1G2	2	0	35	1028	3.60%	16.11%

Subject 3

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	3	1017	0.29%	1.68%
HANGAR	0	0	5	1028	0.49%	2.76%
1G1	0	0	13	1028	1.26%	7.18%
3G	0	0	7	280	2.50%	10.45%
1G2	0	0	29	1038	2.79%	13.19%

Subject 4

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	3	1025	0.29%	1.67%
HANGAR	0	0	1	1038	0.10%	0.55%
1G1	1	1	22	1011	2.37%	12.43%
3G	0	0	6	269	2.23%	9.38%
1G2	0	0	25	1039	2.41%	13.19%

Subject 5

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	11	1010	1.09%	5.65%
HANGAR	1	1	15	1029	1.65%	8.89%
1G1	2	0	48	1042	4.80%	21.98%
3G	1	0	16	280	6.07%	20.90%
1G2	1	0	47	1038	4.62%	21.43%

Subject 6

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	0	0	1028	0.10%	0.55%
HANGAR	0	0	2	1033	0.19%	1.10%
1G1	0	0	3	1013	0.30%	1.68%
3G	0	0	2	266	0.75%	1.56%
1G2	0	0	3	1036	0.29%	1.65%

Subject 7

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	3	1032	0.29%	1.66%
HANGAR	0	0	5	1029	0.49%	2.78%
1G1	0	0	25	1035	2.42%	12.15%
3G	1	1	7	275	3.27%	7.58%
1G2	1	0	18	1038	1.83%	9.89%

Subject 8

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	13	1028	1.26%	6.11%
HANGAR	0	0	5	1033	0.48%	2.76%
1G1	0	0	26	1038	2.50%	12.64%
3G	0	0	6	276	2.17%	7.58%
1G2	0	0	38	1042	3.65%	18.23%

Subject 9

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	2	1038	0.19%	1.10%
HANGAR	0	0	4	861	0.46%	2.61%
1G1	0	0	6	1038	0.58%	2.75%
3G	0	0	1	280	0.36%	1.49%
1G2	0	0	15	1027	1.46%	8.29%

Subject 10

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	19	1034	1.84%	9.94%
HANGAR	0	0	12	1028	1.17%	6.63%
1G1	0	0	26	1038	2.50%	13.74%
3G	0	0	5	280	1.79%	5.97%
1G2	0	0	34	1030	3.30%	16.11%

Subject 11

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	2	4	1028	0.68%	2.76%
HANGAR	0	0	4	1028	0.39%	2.21%
1G1	0	0	21	1033	2.03%	10.50%
3G	0	0	2	275	0.73%	3.03%
1G2	0	0	13	1018	1.28%	6.67%

APPENDIX B (Continued)

models-8khz / WTW = 100

	INS	DEL	SUB	WORDS	WER	
LAB	2	2	49	11302	0.47%	0.6%
HANGAR	4	1	85	11183	0.80%	
1G1	8	3	298	11327	2.73%	3.3%
3G	10	16	117	2957	4.84%	
1G2	16	8	368	11372	3.45%	
Totals	40	30	917	48141	2.05%	

Subject	LAB	HANGAR	1G1	3G	1G2
1	0.00%	0.39%	3.05%	4.00%	3.66%
2	0.68%	0.87%	3.97%	22.83%	8.07%
3	0.59%	1.36%	3.21%	3.57%	4.24%
4	0.20%	0.10%	2.47%	3.35%	3.37%
5	0.69%	1.85%	4.32%	4.64%	4.14%
6	0.19%	0.58%	1.09%	1.88%	0.58%
7	0.29%	0.39%	2.61%	2.91%	3.85%
8	0.68%	1.06%	3.56%	1.45%	4.22%
9	0.10%	0.93%	1.16%	1.07%	1.27%
10	0.87%	0.78%	2.22%	5.71%	3.50%
11	0.88%	0.58%	2.32%	1.45%	0.98%

English-8K-030502 / WTW=100

	INS	DEL	SUB	WORDS	WER	
LAB	1	1	60	11302	0.55%	0.6%
HANGAR	6	1	60	11183	0.60%	
1G1	4	0	234	11327	2.10%	2.5%
3G	6	9	86	2957	3.42%	
1G2	9	0	281	11372	2.55%	
Totals	26	11	721	48141	1.57%	

Subject	LAB	HANGAR	1G1	3G	1G2
1	0.00%	0.67%	2.06%	2.00%	1.83%
2	0.68%	0.67%	2.90%	11.96%	4.18%
3	0.29%	0.49%	1.46%	2.86%	3.08%
4	0.39%	0.10%	1.98%	4.46%	2.41%
5	0.99%	1.65%	4.70%	5.36%	4.62%
6	0.10%	0.39%	0.30%	0.75%	0.29%
7	0.19%	0.39%	2.51%	4.36%	1.93%
8	1.07%	0.39%	2.41%	2.17%	3.74%
9	0.00%	0.58%	0.48%	1.07%	1.36%
10	1.74%	0.97%	2.41%	1.43%	3.20%
11	0.58%	0.29%	1.84%	0.73%	1.38%

APPENDIX B (Continued)

models-8khz, WTW=100

Subject 1

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	1028	0%	0%
HANGAR	1	0	3	1038	0.39%	2.20%
1G1	0	0	31	1017	3.05%	14.61%
3G	0	0	8	200	4%	14.58%
1G2	2	2	34	1038	3.66%	16.48%

Subject 2

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	7	1034	0.68%	3.87%
HANGAR	0	0	9	1038	0.87%	4.95%
1G1	2	0	39	1034	3.97%	19.89%
3G	4	13	46	276	22.83%	42.42%
1G2	6	6	71	1028	8.07%	27.78%

Subject 3

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	6	1017	0.59%	2.79%
HANGAR	0	0	14	1028	1.36%	7.73%
1G1	2	1	30	1028	3.21%	15.47%
3G	1	0	9	280	3.57%	13.43%
1G2	3	0	41	1038	4.24%	19.23%

Subject 4

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	2	1025	0.20%	1.11%
HANGAR	0	0	1	1038	0.10%	0.55%
1G1	0	0	25	1011	2.47%	12.99%
3G	0	1	8	269	3.35%	9.38%
1G2	0	0	35	1039	3.37%	16.48%

Subject 5

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	7	1010	0.69%	3.95%
HANGAR	2	1	16	1029	1.85%	7.78%
1G1	1	1	43	1042	4.32%	18.68%
3G	0	0	13	280	4.64%	17.91%
1G2	2	0	41	1038	4.14%	19.23%

Subject 6

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	0	1	1028	0.19%	1.10%
HANGAR	1	0	5	1033	0.58%	3.31%
1G1	1	0	10	1013	1.09%	6.15%
3G	0	0	5	266	1.88%	7.81%
1G2	0	0	6	1036	0.58%	3.30%

Subject 7

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	3	1032	0.29%	1.66%
HANGAR	0	0	4	1029	0.39%	2.22%
1G1	1	0	26	1035	2.61%	11.60%
3G	1	1	6	275	2.91%	6.06%
1G2	2	0	38	1038	3.85%	17.58%

Subject 8

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	7	1028	0.68%	3.89%
HANGAR	0	0	11	1033	1.06%	5.52%
1G1	0	0	37	1038	3.56%	15.93%
3G	0	0	4	276	1.45%	4.55%
1G2	1	0	43	1042	4.22%	18.23%

Subject 9

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	1038	0.10%	0.55%
HANGAR	0	0	8	861	0.93%	5.23%
1G1	1	0	11	1038	1.16%	5.49%
3G	0	0	3	280	1.07%	2.99%
1G2	0	0	13	1027	1.27%	7.18%

Subject 10

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	9	1034	0.87%	4.97%
HANGAR	0	0	8	1028	0.78%	3.87%
1G1	0	0	23	1038	2.22%	10.99%
3G	3	1	12	280	5.71%	16.42%
1G2	0	0	36	1030	3.50%	16.11%

Subject 11

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	2	6	1028	0.88%	3.87%
HANGAR	0	0	6	1028	0.58%	3.31%
1G1	0	1	23	1033	2.32%	11.05%
3G	1	0	3	275	1.45%	4.55%
1G2	0	0	10	1018	0.98%	5%

APPENDIX B (Continued)

English-8K-030502, WTW=100

Subject 1

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	1028	0%	0%
HANGAR	2	0	5	1038	0.67%	2.75%
1G1	0	0	21	1017	2.06%	11.80%
3G	0	0	4	200	2%	6.25%
1G2	2	0	17	1038	1.83%	9.89%

Subject 2

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	7	1034	0.68%	3.87%
HANGAR	0	0	7	1038	0.67%	3.85%
1G1	1	0	29	1034	2.90%	14.92%
3G	4	6	23	276	11.96%	28.79%
1G2	4	0	39	1028	4.18%	18.89%

Subject 3

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	3	1017	0.29%	1.68%
HANGAR	0	0	5	1028	0.49%	2.76%
1G1	0	0	15	1028	1.46%	7.18%
3G	0	0	8	280	2.86%	11.94%
1G2	1	0	31	1038	3.08%	14.84%

Subject 4

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	4	1025	0.39%	2.22%
HANGAR	0	0	1	1038	0.10%	0.55%
1G1	0	0	20	1011	1.98%	10.73%
3G	0	2	10	269	4.46%	14.06%
1G2	0	0	25	1039	2.41%	13.74%

Subject 5

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	10	1010	0.99%	5.65%
HANGAR	2	1	14	1029	1.65%	8.89%
1G1	2	0	47	1042	4.70%	21.43%
3G	0	0	15	280	5.36%	19.40%
1G2	1	0	47	1038	4.62%	21.98%

Subject 6

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	0	0	1028	0.10%	0.55%
HANGAR	2	0	2	1033	0.39%	2.21%
1G1	0	0	3	1013	0.30%	1.68%
3G	1	0	1	266	0.75%	3.13%
1G2	0	0	3	1036	0.29%	1.65%

Subject 7

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	2	1032	0.19%	1.10%
HANGAR	0	0	4	1029	0.39%	2.22%
1G1	1	0	25	1035	2.51%	12.71%
3G	1	1	10	275	4.36%	12.12%
1G2	1	0	19	1038	1.93%	10.44%

Subject 8

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	11	1028	1.07%	5.56%
HANGAR	0	0	4	1033	0.39%	2.21%
1G1	0	0	25	1038	2.41%	12.64%
3G	0	0	6	276	2.17%	7.58%
1G2	0	0	39	1042	3.74%	18.23%

Subject 9

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	1038	0%	0%
HANGAR	0	0	5	861	0.58%	3.27%
1G1	0	0	5	1038	0.48%	2.20%
3G	0	0	3	280	1.07%	4.48%
1G2	0	0	14	1027	1.36%	7.73%

Subject 10

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	18	1034	1.74%	9.94%
HANGAR	0	0	10	1028	0.97%	5.52%
1G1	0	0	25	1038	2.41%	13.19%
3G	0	0	4	280	1.43%	5.97%
1G2	0	0	33	1030	3.20%	15.56%

Subject 11

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	1	5	1028	0.58%	2.76%
HANGAR	0	0	3	1028	0.29%	1.66%
1G1	0	0	19	1033	1.84%	9.39%
3G	0	0	2	275	0.73%	3.03%
1G2	0	0	14	1018	1.38%	7.22%

APPENDIX B (Continued)

models-8khz / WTW=150

	INS	DEL	SUB	WORDS	WER	
LAB	3	1	50	11302	0.48%	
HANGAR	7	1	91	11183	0.89%	0.7%
1G1	11	3	360	11327	3.30%	
3G	21	22	152	2957	6.59%	
1G2	22	13	448	11372	4.25%	4.1%
Totals	64	40	1101	48141	2.50%	

Subject	LAB	HANGAR	1G1	3G	1G2
1	0.00%	0.39%	3.05%	3.50%	4.53%
2	0.58%	0.87%	3.97%	25.36%	9.73%
3	0.69%	1.56%	5.06%	7.50%	5.88%
4	0.20%	0.19%	3.46%	4.09%	3.56%
5	0.79%	1.85%	4.80%	6.79%	4.53%
6	0.19%	0.77%	1.97%	2.63%	1.64%
7	0.29%	0.39%	3.67%	8.36%	5.20%
8	0.78%	0.97%	3.66%	2.17%	4.32%
9	0.10%	0.93%	1.93%	1.07%	1.66%
10	0.87%	1.26%	2.41%	7.14%	4.17%
11	0.78%	0.58%	2.32%	2.91%	1.47%

English-8K-030502 - / WTW=150

	INS	DEL	SUB	WORDS	WER	
LAB	2	2	62	11302	0.58%	
HANGAR	6	1	66	11183	0.65%	0.6%
1G1	6	1	252	11327	2.29%	
3G	13	18	122	2957	5.17%	
1G2	14	6	343	11372	3.19%	3.0%
Totals	41	28	845	48141	1.90%	

Subject	LAB	HANGAR	1G1	3G	1G2
1	0.00%	0.67%	1.87%	3.00%	2.79%
2	0.39%	0.58%	2.71%	18.84%	6.52%
3	0.39%	0.68%	2.82%	3.93%	4.62%
4	0.29%	0.10%	2.67%	5.95%	3.37%
5	1.29%	1.94%	4.80%	7.14%	4.72%
6	0.10%	0.39%	0.59%	1.13%	0.58%
7	0.19%	0.39%	2.51%	5.09%	2.70%
8	1.26%	0.39%	2.22%	2.17%	3.74%
9	0.10%	0.58%	0.77%	1.43%	1.27%
10	1.84%	1.07%	2.41%	5.00%	3.40%
11	0.58%	0.39%	1.74%	2.55%	1.38%

APPENDIX B (Continued)

models-8khz, WTW=150

Subject 1

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	1028	0%	0%
HANGAR	1	0	3	1038	0.39%	2.20%
1G1	0	0	31	1017	3.05%	14.61%
3G	0	0	7	200	3.50%	14.58%
1G2	2	2	43	1038	4.53%	21.43%

Subject 2

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	6	1034	0.58%	3.31%
HANGAR	0	0	9	1038	0.87%	4.95%
1G1	2	0	39	1034	3.97%	20.44%
3G	4	17	49	276	25.36%	48.48%
1G2	8	8	84	1028	9.73%	32.78%

Subject 3

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	0	6	1017	0.69%	3.35%
HANGAR	0	0	16	1028	1.56%	8.29%
1G1	5	1	46	1028	5.06%	21.55%
3G	5	1	15	280	7.50%	22.39%
1G2	6	0	55	1038	5.88%	21.98%

Subject 4

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	2	1025	0.20%	1.11%
HANGAR	0	0	2	1038	0.19%	1.10%
1G1	0	0	35	1011	3.46%	16.38%
3G	1	0	10	269	4.09%	9.38%
1G2	0	0	37	1039	3.56%	17.03%

Subject 5

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	8	1010	0.79%	4.52%
HANGAR	2	1	16	1029	1.85%	7.78%
1G1	1	1	48	1042	4.80%	20.88%
3G	1	2	16	280	6.79%	19.40%
1G2	2	2	43	1038	4.53%	20.88%

Subject 6

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	0	1	1028	0.19%	1.10%
HANGAR	2	0	6	1033	0.77%	4.42%
1G1	1	0	19	1013	1.97%	10.06%
3G	1	0	6	266	2.63%	9.38%
1G2	0	0	17	1036	1.64%	7.69%

Subject 7

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	3	1032	0.29%	1.66%
HANGAR	0	0	4	1029	0.39%	2.22%
1G1	1	0	37	1035	3.67%	16.02%
3G	3	1	19	275	8.36%	18.18%
1G2	3	0	51	1038	5.20%	23.08%

Subject 8

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	0	7	1028	0.78%	4.44%
HANGAR	0	0	10	1033	0.97%	4.97%
1G1	0	0	38	1038	3.66%	16.48%
3G	0	0	6	276	2.17%	7.58%
1G2	1	0	44	1042	4.32%	18.23%

Subject 9

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	1038	0.10%	0.55%
HANGAR	0	0	8	861	0.93%	5.23%
1G1	1	0	19	1038	1.93%	9.89%
3G	0	0	3	280	1.07%	2.99%
1G2	0	0	17	1027	1.66%	8.84%

Subject 10

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	9	1034	0.87%	4.97%
HANGAR	2	0	11	1028	1.26%	5.52%
1G1	0	0	25	1038	2.41%	12.64%
3G	4	1	15	280	7.14%	20.90%
1G2	0	1	42	1030	4.17%	17.78%

Subject 11

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	1	7	1028	0.78%	3.87%
HANGAR	0	0	6	1028	0.58%	3.31%
1G1	0	1	23	1033	2.32%	9.94%
3G	2	0	6	275	2.91%	9.09%
1G2	0	0	15	1018	1.47%	6.67%

APPENDIX B (Continued)

English-8K-030502, WTW=150

Subject 1

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	1028	0%	0%
HANGAR	2	0	5	1038	0.67%	2.75%
1G1	0	0	19	1017	1.87%	10.67%
3G	0	0	6	200	3%	10.42%
1G2	2	0	27	1038	2.79%	14.84%

Subject 2

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	4	1034	0.39%	2.21%
HANGAR	0	0	6	1038	0.58%	3.30%
1G1	1	0	27	1034	2.71%	13.81%
3G	6	10	36	276	18.84%	42.42%
1G2	5	4	58	1028	6.52%	25%

Subject 3

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	0	3	1017	0.39%	2.23%
HANGAR	0	0	7	1028	0.68%	3.87%
1G1	2	1	26	1028	2.82%	11.60%
3G	1	0	10	280	3.93%	14.93%
1G2	4	1	43	1038	4.62%	21.43%

Subject 4

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	3	1025	0.29%	1.67%
HANGAR	0	0	1	1038	0.10%	0.55%
1G1	0	0	27	1011	2.67%	14.12%
3G	0	2	14	269	5.95%	18.75%
1G2	1	1	33	1039	3.37%	17.03%

Subject 5

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	1	12	1010	1.29%	7.34%
HANGAR	2	1	17	1029	1.94%	11.11%
1G1	2	0	48	1042	4.80%	21.98%
3G	0	2	18	280	7.14%	22.39%
1G2	1	0	48	1038	4.72%	22.53%

Subject 6

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	0	0	1028	0.10%	0.55%
HANGAR	2	0	2	1033	0.39%	2.21%
1G1	0	0	6	1013	0.59%	3.35%
3G	1	0	2	266	1.13%	4.69%
1G2	0	0	6	1036		3.30%

Subject 7

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	2	1032	0.19%	1.10%
HANGAR	0	0	4	1029	0.39%	2.22%
1G1	1	0	25	1035	2.51%	13.26%
3G	2	1	11	275	5.09%	13.64%
1G2	1	0	27	1038	2.70%	13.74%

Subject 8

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	13	1028	1.26%	6.11%
HANGAR	0	0	4	1033	0.39%	2.21%
1G1	0	0	23	1038	2.22%	12.09%
3G	0	0	6	276	2.17%	7.58%
1G2	0	0	39	1042	3.74%	17.68%

Subject 9

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	1038	0.10%	0.55%
HANGAR	0	0	5	861	0.58%	3.27%
1G1	0	0	8	1038	0.77%	3.85%
3G	0	0	4	280	1.43%	4.48%
1G2	0	0	13	1027	1.27%	6.08%

Subject 10

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	19	1034	1.84%	9.94%
HANGAR	0	0	11	1028	1.07%	6.08%
1G1	0	0	25	1038	2.41%	13.19%
3G	1	3	10	280	5%	14.93%
1G2	0	0	35	1030	3.40%	16.11%

Subject 11

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	1	5	1028	0.58%	2.76%
HANGAR	0	0	4	1028	0.39%	2.21%
1G1	0	0	18	1033	1.74%	8.84%
3G	2	0	5	275	2.55%	7.58%
1G2	0	0	14	1018	1.38%	7.22%

APPENDIX B (Continued)

models-8khz / WTW=200

	INS	DEL	SUB	WORDS	WER	
LAB	10	2	63	11302	0.66%	0.8%
HANGAR	13	1	99	11183	1.01%	
1G1	16	5	468	11327	4.32%	5.6%
3G	25	39	215	2957	9.44%	
1G2	42	23	609	11372	5.93%	
Totals	106	70	1454	48141	3.39%	

Subject	LAB	HANGAR	1G1	3G	1G2
1	0.00%	0.39%	3.34%	6.50%	7.03%
2	1.16%	0.87%	4.74%	38.77%	10.89%
3	0.98%	1.85%	7.39%	10.36%	9.06%
4	0.39%	0.10%	5.24%	5.20%	5.10%
5	0.99%	1.65%	4.51%	7.14%	5.78%
6	0.39%	0.97%	3.06%	5.26%	2.80%
7	0.48%	1.07%	4.83%	10.55%	6.74%
8	0.88%	1.06%	4.05%	2.90%	4.99%
9	0.10%	1.28%	3.76%	2.50%	3.21%
10	1.16%	1.36%	3.66%	8.57%	6.70%
11	0.78%	0.58%	2.90%	5.09%	2.85%

English-8K-030502 / WTW=200

	INS	DEL	SUB	WORDS	WER	
LAB	6	8	79	11302	0.82%	0.9%
HANGAR	9	1	98	11183	0.97%	
1G1	10	2	362	11327	3.30%	4.6%
3G	18	34	191	2957	8.22%	
1G2	25	19	522	11372	4.98%	
Totals	68	64	1252	48141	2.87%	

Subject	LAB	HANGAR	1G1	3G	1G2
1	0.19%	0.77%	2.16%	3.50%	6.07%
2	%	0.96%	3.29%	28.99%	9.53%
3	0.29%	1.36%	6.03%	7.14%	8.09%
4	0.29%	0.39%	4.75%	7.81%	5.10%
5	2.57%	2.82%	5.47%	13.21%	6.07%
6	0.19%	0.48%	1.68%	2.26%	1.64%
7	0.39%	1.07%	3.57%	9.82%	5.11%
8	1.95%	0.48%	2.70%	2.17%	4.41%
9	0.19%	0.58%	2.41%	2.50%	2.53%
10	1.45%	0.97%	2.70%	8.57%	4.76%
11	0.78%	0.68%	1.55%	2.91%	1.38%

APPENDIX B (Continued)

models-8khz, WTW=200

Subject 1

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	1028	0%	0%
HANGAR	1	0	3	1038	0.39%	2.20%
1G1	0	0	34	1017	3.34%	15.73%
3G	1	1	11	200	6.50%	20.83%
1G2	8	4	61	1038	7.03%	28.02%

Subject 2

	INS	DEL	SUB	WORDS	WER	SER
LAB	2	0	10	1034	1.16%	5.52%
HANGAR	0	0	9	1038	0.87%	4.95%
1G1	3	0	46	1034	4.74%	23.20%
3G	6	25	76	276	38.77%	60.61%
1G2	9	11	92	1028	10.89%	36.11%

Subject 3

	INS	DEL	SUB	WORDS	WER	SER
LAB	2	0	8	1017	0.98%	4.47%
HANGAR	1	0	18	1028	1.85%	9.94%
1G1	6	3	67	1028	7.39%	28.18%
3G	5	2	22	280	10.36%	26.87%
1G2	7	2	85	1038	9.06%	31.32%

Subject 4

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	0	3	1025	0.39%	1.67
HANGAR	0	0	1	1038	0.10%	0.55%
1G1	2	0	51	1011	5.24%	22.03%
3G	0	3	11	269	5.20%	15.63%
1G2	1	1	51	1039	5.10%	21.43%

Subject 5

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	1	9	1010	0.99%	4.52%
HANGAR	2	1	14	1029	1.65%	7.22%
1G1	0	1	46	1042	4.51%	21.43%
3G	0	2	18	280	7.14%	20.90%
1G2	2	4	54	1038	5.78%	23.63%

Subject 6

	INS	DEL	SUB	WORDS	WER	SER
LAB	2	0	2	1028	0.39%	2.21%
HANGAR	3	0	7	1033	0.97%	5.52%
1G1	1	0	30	1013	3.06%	15.08%
3G	2	2	10	266	5.26%	14.06%
1G2	0	0	29	1036	2.80%	13.74%

Subject 7

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	5	1032	0.48%	2.76%
HANGAR	2	0	9	1029	1.07%	5%
1G1	1	0	49	1035	4.83%	19.34%
3G	3	2	24	275	10.55%	28.79%
1G2	5	0	65	1038	6.74%	28.57%

Subject 8

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	0	8	1028	0.88%	3.89%
HANGAR	0	0	11	1033	1.06%	5.52%
1G1	0	0	42	1038	4.05%	18.13%
3G	0	0	8	276	2.90%	9.09%
1G2	1	0	51	1042	4.99%	20.44%

Subject 9

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	1038	0.10%	0.55%
HANGAR	1	0	10	861	1.28%	6.54%
1G1	1	0	38	1038	3.76%	17.03%
3G	0	0	7	280	2.50%	8.96%
1G2	0	0	33	1027	3.21%	16.57%

Subject 10

	INS	DEL	SUB	WORDS	WER	SER
LAB	2	0	10	1034	1.16%	6.08%
HANGAR	3	0	11	1028	1.36%	5.52%
1G1	2	0	36	1038	3.66%	15.93%
3G	5	1	18	280	8.57%	25.37%
1G2	7	1	61	1030	6.70%	25%

Subject 11

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	1	7	1028	0.78%	3.87%
HANGAR	0	0	6	1028	0.58%	3.31%
1G1	0	1	29	1033	2.90%	12.15%
3G	3	1	10	275	5.09%	15.15%
1G2	2	0	27	1018	2.85%	12.22%

APPENDIX B (Continued)

English-8K-030502, WTW=200

Subject 1

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	2	1028	0.19%	1.10%
HANGAR	1	0	7	1038	0.77%	4.40%
1G1	0	0	22	1017	2.16%	12.36%
3G	0	0	7	200	3.50%	12.50%
1G2	8	5	50	1038	6.07%	25.27%

Subject 2

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	0	7	1034	0.77%	3.87%
HANGAR	0	0	10	1038	0.96%	4.95%
1G1	1	0	33	1034	3.29%	17.13%
3G	6	17	57	276	28.99%	53.03%
1G2	8	7	83	1028	9.53%	35%

Subject 3

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	0	2	1017	0.29%	1.68%
HANGAR	1	0	13	1028	1.36%	6.63%
1G1	5	1	56	1028	6.03%	23.20%
3G	4	0	16	280	7.14%	20.90%
1G2	6	2	76	1038	8.09%	30.22%

Subject 4

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	3	1025	0.29%	1.67%
HANGAR	0	0	4	1038	0.39%	2.20%
1G1	0	0	48	1011	4.75%	21.47%
3G	1	2	18	269	7.81%	25%
1G2	1	1	51	1039	5.10%	23.63%

Subject 5

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	7	19	1010	2.57%	14.12%
HANGAR	2	1	26	1029	2.82%	14.44%
1G1	3	1	53	1042	5.47%	25.27%
3G	0	8	29	280	13.21%	34.33%
1G2	0	1	62	1038	6.07%	27.47%

Subject 6

	INS	DEL	SUB	WORDS	WER	SER
LAB	2	0	0	1028	0.19%	1.10%
HANGAR	3	0	2	1033	0.48%	2.76%
1G1	0	0	17	1013	1.68%	8.94%
3G	0	0	6	266	2.26%	9.38%
1G2	0	1	16	1036	1.64%	8.79%

Subject 7

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	4	1032	0.39%	2.21%
HANGAR	2	0	9	1029	1.07%	5%
1G1	1	0	36	1035	3.57%	17.13%
3G	2	3	22	275	9.82%	24.24%
1G2	2	1	50	1038	5.11%	23.63%

Subject 8

	INS	DEL	SUB	WORDS	WER	SER
LAB	2	0	18	1028	1.95%	8.33%
HANGAR	0	0	5	1033	0.48%	2.76%
1G1	0	0	28	1038	2.70%	13.74%
3G	0	0	6	276	2.17%	7.58%
1G2	0	0	46	1042	4.41%	22.10%

Subject 9

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	2	1038	0.19%	1.10%
HANGAR	0	0	5	861	0.58%	3.27%
1G1	0	0	25	1038	2.41%	11.54%
3G	0	0	7	280	2.50%	7.46%
1G2	0	0	26	1027	2.53%	12.15%

Subject 10

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	15	1034	1.45%	7.73%
HANGAR	0	0	10	1028	0.97%	5.52%
1G1	0	0	28	1038	2.70%	14.29%
3G	3	4	17	280	8.57%	25.37%
1G2	0	1	48	1030	4.76%	20%

Subject 11

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	1	7	1028	0.78%	3.87%
HANGAR	0	0	7	1028	0.68%	3.87%
1G1	0	0	16	1033	1.55%	7.18%
3G	2	0	6	275	2.91%	9.09%
1G2	0	0	14	1018	1.38%	6.67%

APPENDIX C:

DYNASPEAK OV-10D GRAMMAR FILE

```

azimuth = ae z ih m ih th;
nav = n ae v;
strafe = s t r ey f;
whats-my = w ah s m ay;
ils = ay eh l eh s;
hi-tacan = hh ay t ae k ae n;
air-to-ground = eh r t uw g r ow n d;
air-to-ground = eh r t ah g r ow n d;
air-to-ground = eh r d ah g r ow n d;
air-to-air = eh r t uw eh r;
air-to-air = eh r t ah eh r;
air-to-air = eh r d ah eh r;
black-hot = b l ae k hh aa t;
white-hot = w ay t hh aa t;
targeting-pod = t aa r g ah t ih ng p aa d;
ccip = s iy s iy ay p iy;
comm2 = k aa m t uw;
comm1 = k aa m w ah n;
cursor-zero = k er s er z iy r ow;
cursor-zero = k er s er z ih r ow;
niner = n ay n er;
niner = n ay n;

<DIGIT0_9> = zero | one | two | three | four | five | six | seven | eight |
niner;
<DIGIT0_5> = zero | one | two | three | four | five;
<DIGIT0_6> = zero | one | two | three | four | five | six;
<DIGIT1_4> = one | two | three | four;
<DIGIT3_9> = three | four | five | six | seven | eight | niner;
<DIGIT2_3> = two | three;
<DIGIT0_2> = zero | one | two;
<UNIFORM_COMM1> = uniform | comm1;
<UHF_FREQ> = (<DIGIT2_3> <DIGIT0_9> <DIGIT0_9> <DIGIT0_9>);
<BUT_CHAN> = button | channel;
<CHANNEL> = (<BUT_CHAN> ((one <DIGIT0_9>) | (two zero) | <DIGIT3_9>));
<VICTOR_COMM2> = victor | comm2;
<VHF_FREQ> = (one <DIGIT0_5> <DIGIT0_9> <DIGIT0_9>);
<RNG_VAL> = ten | twenty | forty | eighty;
<AZ_VAL> = ten | thirty | sixty;
<HITCN_ILS> = hi-tacan | ils;
<LEFT_RIGHT> = left | right;
<RWY_VAL> = ((<DIGIT0_2> <DIGIT0_9> [<LEFT_RIGHT>]) |
(three <DIGIT0_6> [<LEFT_RIGHT>]));
<SAY_WHATSMY> = say | whats-my;
<FUEL_INVENTORY> = fuel | inventory;
<TRACKER_TGP> = tracker | targeting-pod;
<TGP_MODE> = wide | narrow | cursor-zero | black-hot | white-hot;
<MasterModeCommand> = ((air-to-air mode) | (air-to-ground mode) |
(nav mode) | ccip | strafe);
<UHFCCommand> = (<UNIFORM_COMM1> <UHF_FREQ>);
<UHFCChanCommand> = (<UNIFORM_COMM1> <CHANNEL>);

```

APPENDIX C (Continued)

```
<VHFCommand> = (<VICTOR_COMM2> <VHF_FREQ>);
<VHFChanCommand> = (<VICTOR_COMM2> <CHANNEL>);
<RdrRangeCommand> = (radar range <RNG_VAL>);
<RdrAzCommand> = (radar azimuth <AZ_VAL>);
<HTCN_ILSCommand> = (<HITCN_ILS> runway <RWY_VAL>);
<SayFuelInvCommand> = (<SAY_WHATSMY> <FUEL_INVENTORY>);
<RdrElBarCommand> = (radar <DIGIT1_4> bar);
<TrackerCommand> = (<TRACKER_TGP> <TGP_MODE>);

public <OV10D> = <UHFCommand> | <UHFChanCommand> | <VHFCommand> |
<VHFChanCommand> | <RdrRangeCommand> | <RdrAzCommand> | <HTCN_ILSCommand> |
<SayFuelInvCommand> | <RdrElBarCommand> | <TrackerCommand> |
<MasterModeCommand>;
```


APPENDIX D:

OV-10D WORD ERROR RATES BY SUBJECT AND TEST CONDITION

models-8khz / WTW=-200

	INS	DEL	SUB	WORDS	WER	
LAB	0	3	52	3805	1.45%	1.6%
HANGAR	2	8	59	3781	1.82%	
1G1	0	2	44	3876	1.19%	2.3%
4G	3	16	84	1760	5.85%	
1G2	2	9	64	3931	1.91%	
Totals	7	38	303	17153	2.03%	

Subject	LAB	HANGAR	1G1	4G	1G2
1	2.31%	4.06%	4.91%	7.64%	3.20%
2	3.18%	0.89%	0.88%	24.50%	7.06%
3	0.29%	0.00%	0.00%	0.95%	0.44%
4	1.14%	1.73%	1.10%	2.55%	0.80%
5	2.65%	2.35%	1.16%	10.67%	1.16%
6	0.58%	1.16%	1.17%	5.84%	3.18%
7	0.58%	0.00%	0.00%	0.65%	0.00%
8	0.29%	0.87%	0.87%	2.60%	0.58%
9	0.00%	0.29%	0.00%	2.35%	1.67%
10	2.31%	6.41%	0.59%	5.26%	1.45%
11	2.62%	2.35%	2.73%	3.97%	2.31%
12	1.19%	0.87%	0.87%	4.52%	2.02%

English-8K-030502 / WTW=-200

	INS	DEL	SUB	WORDS	WER	
LAB	1	0	19	3805	0.53%	1.0%
HANGAR	3	13	42	3781	1.53%	
1G1	0	2	34	3876	0.93%	1.4%
4G	1	7	27	1760	1.99%	
1G2	0	14	46	3931	1.53%	
Totals	5	36	168	17153	1.22%	

Subject	LAB	HANGAR	1G1	4G	1G2
1	0.00%	1.74%	2.02%	0.64%	4.07%
2	2.02%	1.48%	2.63%	6.62%	6.75%
3	0.29%	0.00%	0.00%	0.48%	0.22%
4	0.00%	1.16%	0.55%	1.91%	0.27%
5	0.29%	3.23%	0.58%	5.33%	1.16%
6	0.29%	0.29%	0.29%	1.95%	0.87%
7	0.00%	0.00%	0.00%	0.00%	0.29%
8	0.29%	0.00%	0.29%	0.00%	0.00%
9	0.00%	0.58%	0.58%	1.76%	1.67%
10	2.02%	5.83%	0.88%	1.97%	1.45%
11	0.58%	2.64%	2.73%	1.99%	0.87%
12	0.30%	0.58%	0.58%	2.58%	1.16%

APPENDIX D (Continued)

models-8khz, WTW=-200

Subject 1

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	8	346	2.31%	7.02%
HANGAR	0	2	12	345	4.06%	8.85%
1G1	0	1	16	346	4.91%	13.16%
4G	0	1	11	157	7.64%	14.08%
1G2	0	1	10	344	3.20%	7.96%

Subject 2

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	2	9	346	3.18%	7.89%
HANGAR	0	1	2	338	0.89%	1.80%
1G1	0	0	3	342	0.88%	2.68%
4G	1	9	27	151	24.50%	23.19%
1G2	1	5	17	326	7.06%	11.71%

Subject 3

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	346	0.29%	0.88%
HANGAR	0	0	0	383	0%	0%
1G1	0	0	0	426	0%	0%
4G	0	0	2	210	0.95%	2.06%
1G2	0	0	2	452	0.44%	1.43%

Subject 4

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	4	351	1.14%	3.48%
HANGAR	0	0	6	346	1.73%	5.26%
1G1	0	0	4	365	1.10%	3.39%
4G	0	0	4	157	2.55%	5.63%
1G2	0	0	3	374	0.80%	2.50%

Subject 5

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	9	339	2.65%	8.11%
HANGAR	0	1	7	341	2.35%	7.14%
1G1	0	1	3	346	1.16%	3.51%
4G	0	3	13	150	10.67%	13.24%
1G2	1	0	3	346	1.16%	2.63%

Subject 6

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	2	344	0.58%	1.77%
HANGAR	0	0	4	346	1.16%	3.51%
1G1	0	0	4	343	1.17%	3.54%
4G	0	2	7	154	5.84%	7.14%
1G2	0	3	8	346	3.18%	4.39%

Subject 7

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	2	346	0.58%	1.75%
HANGAR	0	0	0	306	0%	0%
1G1	0	0	0	347	0%	0%
4G	0	0	1	154	0.65%	1.43%
1G2	0	0	0	346	0%	0%

Subject 8

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	346	0.29%	0.88%
HANGAR	0	0	3	346	0.87%	2.63%
1G1	0	0	3	346	0.87%	2.63%
4G	0	0	4	154	2.60%	5.71%
1G2	0	0	2	346	0.58%	1.75%

Subject 9

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	352	0%	0%
HANGAR	0	0	1	346	0.29%	0.88%
1G1	0	0	0	346	0%	0%
4G	0	0	4	170	2.35%	5.13%
1G2	0	0	6	360	1.67%	5.08%

Subject 10

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	1	7	346	2.31%	5.26%
HANGAR	2	3	17	343	6.41%	14.16%
1G1	0	0	2	339	0.59%	1.79%
4G	0	1	7	152	5.26%	8.70%
1G2	0	0	5	345	1.45%	4.39%

Subject 11

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	9	343	2.62%	7.08%
HANGAR	0	1	7	341	2.35%	4.42%
1G1	0	0	9	330	2.73%	7.41%
4G	2	0	4	151	3.97%	4.41%
1G2	0	0	8	346	2.31%	7.02%

Subject 12

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	4	336	1.19%	3.57%
HANGAR	0	0	3	346	0.87%	2.63%
1G1	0	0	3	343	0.87%	2.65%
4G	0	0	7	155	4.52%	9.86%
1G2	0	0	7	346	2.02%	5.26%

APPENDIX D (Continued)

English-8K-030502, WTW=-200

Subject 1

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	346	0%	0%
HANGAR	0	0	6	345	1.74%	5.31%
1G1	0	0	7	346	2.02%	6.14%
4G	0	0	1	157	0.64%	1.41%
1G2	0	2	12	344	4.07%	8.85%

Subject 2

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	7	346	2.02%	5.26%
HANGAR	0	0	5	338	1.48%	2.70%
1G1	0	1	8	342	2.63%	7.14%
4G	1	1	8	151	6.62%	5.80%
1G2	0	9	13	326	6.75%	10.81%

Subject 3

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	346	0.29%	0.88%
HANGAR	0	0	0	383	0%	0%
1G1	0	0	0	426	0%	0%
4G	0	0	1	210	0.48%	1.03%
1G2	0	0	1	452	0.22%	0.71%

Subject 4

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	351	0%	0%
HANGAR	1	1	2	346	1.16%	2.63%
1G1	0	0	2	365	0.55%	1.69%
4G	0	0	3	157	1.91%	4.23%
1G2	0	0	1	374	0.27%	0.83%

Subject 5

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	339	0.29%	0.90%
HANGAR	0	3	8	341	3.23%	7.14%
1G1	0	1	1	346	0.58%	1.75%
4G	0	4	4	150	5.33%	5.88%
1G2	0	1	3	346	1.16%	2.63%

Subject 6

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	344	0.29%	0.88%
HANGAR	0	0	1	346	0.29%	0.88%
1G1	0	0	1	343	0.29%	0.88%
4G	0	2	1	154	1.95%	1.43%
1G2	0	0	3	346	0.87%	2.63%

Subject 7

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	346	0%	0%
HANGAR	0	0	0	306	0%	0%
1G1	0	0	0	347	0%	0%
4G	0	0	0	154	0%	0%
1G2	0	0	1	346	0.29%	0.88%

Subject 8

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	346	0.29%	0.88%
HANGAR	0	0	0	346	0%	0%
1G1	0	0	1	346	0.29%	0.88%
4G	0	0	0	154	0%	0%
1G2	0	0	0	346	0%	0%

Subject 9

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	352	0%	0%
HANGAR	0	0	2	346	0.58%	1.75%
1G1	0	0	2	346	0.58%	1.75%
4G	0	0	3	170	1.76%	3.85%
1G2	0	0	6	360	1.67%	5.08%

Subject 10

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	0	6	346	2.02%	5.26%
HANGAR	1	6	13	343	5.83%	9.73%
1G1	0	0	3	339	0.88%	2.68%
4G	0	0	3	152	1.97%	4.35%
1G2	0	2	3	345	1.45%	3.51%

Subject 11

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	2	343	0.58%	1.77%
HANGAR	1	3	5	341	2.64%	6.19%
1G1	0	0	9	330	2.73%	7.41%
4G	0	0	3	151	1.99%	4.41%
1G2	0	0	3	346	0.87%	2.63%

Subject 12

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	336	0.30%	0.89%
HANGAR	0	0	2	346	0.58%	1.75%
1G1	0	0	2	343	0.58%	1.77%
4G	2	0	2	155	2.58%	1.41%
1G2	0	0	4	346	1.16%	3.51%

APPENDIX D (Continued)

models-8khz / WTW=-150

	INS	DEL	SUB	WORDS	WER	
LAB	0	3	53	3805	1.47%	1.6%
HANGAR	2	6	60	3781	1.80%	
1G1	0	2	44	3876	1.19%	2.2%
4G	3	14	82	1760	5.63%	
1G2	1	6	58	3931	1.65%	
Totals	6	31	297	17153	1.95%	

Subject	LAB	HANGAR	1G1	4G	1G2
1	2.31%	3.77%	4.62%	8.28%	3.20%
2	3.18%	0.30%	0.88%	21.85%	5.52%
3	0.29%	0.00%	0.00%	0.95%	0.66%
4	1.14%	1.73%	1.10%	2.55%	0.80%
5	2.36%	2.35%	1.16%	10.00%	0.87%
6	0.58%	1.45%	0.87%	3.90%	2.31%
7	0.58%	0.00%	0.00%	1.30%	0.00%
8	0.58%	0.87%	0.87%	2.60%	0.58%
9	0.00%	0.29%	0.00%	2.94%	1.67%
10	3.18%	6.41%	0.59%	5.92%	1.16%
11	2.04%	2.64%	3.33%	3.97%	2.02%
12	1.19%	0.87%	0.87%	4.52%	1.73%

English-8K-030502 / WTW=-150

	INS	DEL	SUB	WORDS	WER	
LAB	1	0	15	3805	0.42%	1.0%
HANGAR	3	11	44	3781	1.53%	
1G1	0	1	31	3876	0.83%	1.3%
4G	3	4	28	1760	1.99%	
1G2	0	10	50	3931	1.53%	
Totals	7	26	168	17153	1.17%	

Subject	LAB	HANGAR	1G1	4G	1G2
1	0.00%	2.03%	2.02%	0.64%	3.49%
2	1.45%	1.18%	2.34%	7.95%	5.83%
3	0.29%	0.00%	0.00%	0.95%	0.66%
4	0.00%	1.45%	0.55%	1.91%	0.53%
5	0.29%	3.23%	0.58%	4.00%	1.16%
6	0.00%	0.29%	0.29%	1.95%	0.87%
7	0.00%	0.00%	0.00%	0.00%	0.29%
8	0.00%	0.00%	0.29%	0.00%	0.29%
9	0.00%	0.58%	0.58%	1.18%	2.22%
10	2.02%	5.83%	0.29%	1.97%	1.45%
11	0.58%	2.35%	2.42%	1.99%	0.58%
12	0.00%	0.58%	0.87%	2.58%	1.16%

APPENDIX D (Continued)

models-8khz, WTW=-150

Subject 1

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	8	346	2.31%	7.02%
HANGAR	0	1	12	345	3.77%	8.85%
1G1	0	1	15	346	4.62%	12.28%
4G	0	1	12	157	8.28%	15.49%
1G2	0	1	10	344	3.20%	7.96%

Subject 7

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	2	346	0.58%	1.75%
HANGAR	0	0	0	306	0%	0%
1G1	0	0	0	347	0%	0%
4G	0	0	2	154	1.30%	2.86%
1G2	0	0	0	346	0%	0%

Subject 2

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	2	9	346	3.18%	7.89%
HANGAR	0	0	1	338	0.30%	0.90%
1G1	0	0	3	342	0.88%	2.68%
4G	1	8	24	151	21.85%	20.29%
1G2	0	3	15	326	5.52%	9.91%

Subject 8

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	2	346	0.58%	1.75%
HANGAR	0	0	3	346	0.87%	2.63%
1G1	0	0	3	346	0.87%	2.63%
4G	0	0	4	154	2.60%	5.71%
1G2	0	0	2	346	0.58%	1.75%

Subject 3

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	346	0.29%	0.88%
HANGAR	0	0	0	383	0%	0%
1G1	0	0	0	426	0%	0%
4G	0	0	2	210	0.95%	2.06%
1G2	0	0	3	452	0.66%	2.14%

Subject 9

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	352	0%	0%
HANGAR	0	0	1	346	0.29%	0.88%
1G1	0	0	0	346	0%	0%
4G	0	0	5	170	2.94%	6.41%
1G2	0	0	6	360	1.67%	5.08%

Subject 4

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	4	351	1.14%	3.48%
HANGAR	0	0	6	346	1.73%	5.26%
1G1	0	0	4	365	1.10%	3.39%
4G	0	0	4	157	2.55%	5.63%
1G2	0	0	3	374	0.80%	2.50%

Subject 10

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	1	10	346	3.18%	7.02%
HANGAR	2	3	17	343	6.41%	14.16%
1G1	0	0	2	339	0.59%	1.79%
4G	0	1	8	152	5.92%	10.14%
1G2	0	0	4	345	1.16%	3.51%

Subject 5

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	8	339	2.36%	7.21%
HANGAR	0	1	7	341	2.35%	7.14%
1G1	0	1	3	346	1.16%	3.51%
4G	0	3	12	150	10%	13.24%
1G2	1	0	2	346	0.87%	1.75%

Subject 11

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	7	343	2.04%	5.31%
HANGAR	0	1	8	341	2.64%	5.31%
1G1	0	0	11	330	3.33%	9.26%
4G	2	0	4	151	3.97%	4.41%
1G2	0	0	7	346	2.02%	6.14%

Subject 6

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	2	344	0.58%	1.77%
HANGAR	0	0	5	346	1.45%	4.39%
1G1	0	0	3	343	0.87%	2.65%
4G	0	1	5	154	3.90%	5.71%
1G2	0	2	6	346	2.31%	3.51%

Subject 12

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	4	336	1.19%	3.57%
HANGAR	0	0	3	346	0.87%	2.63%
1G1	0	0	3	343	0.87%	2.65%
4G	0	0	7	155	4.52%	9.86%
1G2	0	0	6	346	1.73%	4.39%

APPENDIX D (Continued)

English-8K-030502, WTW=-150

Subject 1

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	346	0%	0%
HANGAR	0	0	7	345	2.03%	6.19%
1G1	0	0	7	346	2.02%	6.14%
4G	0	0	1	157	0.64%	1.41%
1G2	0	2	10	344	3.49%	7.08%

Subject 2

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	5	346	1.45%	3.51%
HANGAR	0	0	4	338	1.18%	2.70%
1G1	0	0	8	342	2.34%	7.14%
4G	3	0	9	151	7.95%	5.80%
1G2	0	5	14	326	5.83%	10.81%

Subject 3

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	346	0.29%	0.88%
HANGAR	0	0	0	383	0%	0%
1G1	0	0	0	426	0%	0%
4G	0	0	2	210	0.95%	2.06%
1G2	0	0	3	452	0.66%	2.14%

Subject 4

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	351	0%	0%
HANGAR	1	1	3	346	1.45%	3.51%
1G1	0	0	2	365	0.55%	1.69%
4G	0	0	3	157	1.91%	4.23%
1G2	0	0	2	374	0.53%	1.67%

Subject 5

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	339	0.29%	0.90%
HANGAR	0	3	8	341	3.23%	8.04%
1G1	0	1	1	346	0.58%	1.75%
4G	0	2	4	150	4%	5.88%
1G2	0	1	3	346	1.16%	2.63%

Subject 6

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	344	0%	0%
HANGAR	0	0	1	346	0.29%	0.88%
1G1	0	0	1	343	0.29%	0.88%
4G	0	2	1	154	1.95%	1.43%
1G2	0	0	3	346	0.87%	2.63%

Subject 7

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	346	0%	0%
HANGAR	0	0	0	306	0%	0%
1G1	0	0	0	347	0%	0%
4G	0	0	0	154	0%	0%
1G2	0	0	1	346	0.29%	0.88%

Subject 8

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	346	0%	0%
HANGAR	0	0	0	346	0%	0%
1G1	0	0	1	346	0.29%	0.88%
4G	0	0	0	154	0%	0%
1G2	0	0	1	346	0.29%	0.88%

Subject 9

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	352	0%	0%
HANGAR	0	0	2	346	0.58%	1.75%
1G1	0	0	2	346	0.58%	1.75%
4G	0	0	2	170	1.18%	2.56%
1G2	0	0	8	360	2.22%	6.78%

Subject 10

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	0	6	346	2.02%	5.26%
HANGAR	1	5	14	343	5.83%	9.73%
1G1	0	0	1	339	0.29%	0.89%
4G	0	0	3	152	1.97%	4.35%
1G2	0	2	3	345	1.45%	3.51%

Subject 11

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	2	343	0.58%	1.77%
HANGAR	1	2	5	341	2.35%	5.31%
1G1	0	0	8	330	2.42%	6.48%
4G	0	0	3	151	1.99%	4.41%
1G2	0	0	2	346	0.58%	1.75%

Subject 12

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	336	0%	0%
HANGAR	0	0	2	346	0.58%	1.75%
1G1	0	0	3	343	0.87%	2.65%
4G	2	0	2	155	2.58%	1.41%
1G2	0	0	4	346	1.16%	3.51%

APPENDIX D (Continued)

models-8khz / WTW=-100

	INS	DEL	SUB	WORDS	WER	
LAB	0	3	46	3805	1.29%	1.5%
HANGAR	4	5	57	3781	1.75%	
1G1	0	2	44	3876	1.19%	2.2%
4G	12	9	76	1760	5.51%	
1G2	1	4	58	3931	1.60%	
Totals	17	23	281	17153	1.87%	

Subject	LAB	HANGAR	1G1	4G	1G2
1	2.31%	3.77%	4.91%	15.29%	2.91%
2	2.31%	0.59%	0.58%	13.91%	4.29%
3	0.29%	0.00%	0.00%	0.95%	1.33%
4	1.14%	1.73%	0.82%	2.55%	0.80%
5	1.77%	2.35%	1.16%	8.67%	2.02%
6	0.87%	0.87%	0.87%	4.55%	1.45%
7	0.58%	0.00%	0.00%	0.65%	0.00%
8	0.58%	0.87%	0.87%	2.60%	0.29%
9	0.00%	1.45%	0.00%	2.94%	1.94%
10	2.31%	4.96%	0.59%	6.58%	0.87%
11	2.04%	2.64%	3.64%	3.97%	2.02%
12	1.19%	0.58%	0.87%	3.87%	2.02%

English-8K-030502 / WTW=-100

	INS	DEL	SUB	WORDS	WER	
LAB	3	0	14	3805	0.45%	0.9%
HANGAR	1	3	44	3781	1.27%	
1G1	0	1	32	3876	0.85%	1.3%
4G	5	4	29	1760	2.16%	
1G2	0	7	51	3931	1.48%	
Totals	9	15	170	17153	1.13%	

Subject	LAB	HANGAR	1G1	4G	1G2
1	0.00%	2.03%	2.31%	1.27%	3.49%
2	2.02%	1.18%	2.34%	7.95%	5.52%
3	0.29%	0.26%	0.00%	1.90%	0.66%
4	0.00%	0.87%	0.55%	1.91%	0.53%
5	0.29%	2.64%	0.58%	4.00%	0.87%
6	0.00%	0.29%	0.29%	1.95%	0.58%
7	0.00%	0.00%	0.00%	0.00%	0.29%
8	0.00%	0.00%	0.29%	0.00%	0.29%
9	0.57%	0.58%	0.58%	1.76%	1.94%
10	1.73%	4.37%	0.00%	1.97%	1.45%
11	0.00%	1.76%	2.73%	1.32%	1.16%
12	0.00%	0.29%	0.87%	2.58%	1.16%

APPENDIX D (Continued)

models-8khz, WTW=-100

Subject 1

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	8	346	2.31%	7.02%
HANGAR	0	1	12	345	3.77%	8.85%
1G1	0	1	16	346	4.91%	13.16%
4G	9	1	14	157	15.29%	14.08%
1G2	0	0	10	344	2.91%	8.85%

Subject 2

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	2	6	346	2.31%	5.26%
HANGAR	0	0	2	338	0.59%	1.80%
1G1	0	0	2	342	0.58%	1.79%
4G	1	4	16	151	13.91%	13.04%
1G2	0	3	11	326	4.29%	8.11%

Subject 3

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	346	0.29%	0.88%
HANGAR	0	0	0	383	0%	0%
1G1	0	0	0	426	0%	0%
4G	0	0	2	210	0.95%	2.06%
1G2	0	0	6	452	1.33%	4.29%

Subject 4

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	4	351	1.14%	3.48%
HANGAR	0	0	6	346	1.73%	5.26%
1G1	0	0	3	365	0.82%	2.54%
4G	0	0	4	157	2.55%	5.63%
1G2	0	0	3	374	0.80%	2.50%

Subject 5

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	6	339	1.77%	5.41%
HANGAR	0	1	7	341	2.35%	7.14%
1G1	0	1	3	346	1.16%	3.51%
4G	0	2	11	150	8.67%	13.24%
1G2	1	0	6	346	2.02%	3.51%

Subject 6

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	3	344	0.87%	2.65%
HANGAR	0	0	3	346	0.87%	2.63%
1G1	0	0	3	343	0.87%	2.65%
4G	0	1	6	154	4.55%	7.14%
1G2	0	1	4	346	1.45%	2.63%

Subject 7

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	2	346	0.58%	1.75%
HANGAR	0	0	0	306	0%	0%
1G1	0	0	0	347	0%	0%
4G	0	0	1	154	0.65%	1.43%
1G2	0	0	0	346	0%	0%

Subject 8

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	2	346	0.58%	1.75%
HANGAR	0	0	3	346	0.87%	2.63%
1G1	0	0	3	346	0.87%	2.63%
4G	0	0	4	154	2.60%	5.71%
1G2	0	0	1	346	0.29%	0.88%

Subject 9

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	352	0%	0%
HANGAR	2	0	3	346	1.45%	1.75%
1G1	0	0	0	346	0%	0%
4G	0	0	5	170	2.94%	6.41%
1G2	0	0	7	360	1.94%	5.93%

Subject 10

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	1	7	346	2.31%	5.26%
HANGAR	2	2	13	343	4.96%	11.50%
1G1	0	0	2	339	0.59%	1.79%
4G	0	1	9	152	6.58%	11.59%
1G2	0	0	3	345	0.87%	2.63%

Subject 11

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	7	343	2.04%	5.31%
HANGAR	0	1	8	341	2.64%	5.31%
1G1	0	0	12	330	3.64%	10.19%
4G	2	0	4	151	3.97%	4.41%
1G2	0	0	7	346	2.02%	6.14%

Subject 12

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	4	336	1.19%	3.57%
HANGAR	0	0	2	346	0.58%	1.75%
1G1	0	0	3	343	0.87%	2.65%
4G	0	0	6	155	3.87%	8.45%
1G2	0	0	7	346	2.02%	5.26%

APPENDIX D (Continued)

English-8K-030502, WTW=-100

Subject 1

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	346	0%	0%
HANGAR	0	0	7	345	2.03%	6.19%
1G1	0	0	8	346	2.31%	7.02%
4G	0	0	2	157	1.27%	2.82%
1G2	0	2	10	344	3.49%	7.08%

Subject 2

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	7	346	2.02%	5.26%
HANGAR	0	0	4	338	1.18%	2.70%
1G1	0	0	8	342	2.34%	7.14%
4G	3	0	9	151	7.95%	5.80%
1G2	0	3	15	326	5.52%	10.81%

Subject 3

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	346	0.29%	0.88%
HANGAR	0	0	1	383	0.26%	0.81%
1G1	0	0	0	426	0%	0%
4G	2	0	2	210	1.90%	1.03%
1G2	0	0	3	452	0.66%	2.14%

Subject 4

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	351	0%	0%
HANGAR	0	0	3	346	0.87%	2.63%
1G1	0	0	2	365	0.55%	1.69%
4G	0	0	3	157	1.91%	4.23%
1G2	0	0	2	374	0.53%	1.67%

Subject 5

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	339	0.29%	0.90%
HANGAR	0	0	9	341	2.64%	8.04%
1G1	0	1	1	346	0.58%	1.75%
4G	0	2	4	150	4%	5.88%
1G2	0	0	3	346	0.87%	2.63%

Subject 6

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	344	0%	0%
HANGAR	0	0	1	346	0.29%	0.88%
1G1	0	0	1	343	0.29%	0.88%
4G	0	2	1	154	1.95%	1.43%
1G2	0	0	2	346	0.58%	1.75%

Subject 7

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	346	0%	0%
HANGAR	0	0	0	306	0%	0%
1G1	0	0	0	347	0%	0%
4G	0	0	0	154	0%	0%
1G2	0	0	1	346	0.29%	0.88%

Subject 8

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	346	0%	0%
HANGAR	0	0	0	346	0%	0%
1G1	0	0	1	346	0.29%	0.88%
4G	0	0	0	154	0%	0%
1G2	0	0	1	346	0.29%	0.88%

Subject 9

	INS	DEL	SUB	WORDS	WER	SER
LAB	2	0	0	352	0.57%	1.72%
HANGAR	0	0	2	346	0.58%	1.75%
1G1	0	0	2	346	0.58%	1.75%
4G	0	0	3	170	1.76%	3.85%
1G2	0	0	7	360	1.94%	5.93%

Subject 10

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	0	5	346	1.73%	4.39%
HANGAR	1	2	12	343	4.37%	8.85%
1G1	0	0	0	339	0%	0%
4G	0	0	3	152	1.97%	4.35%
1G2	0	2	3	345	1.45%	3.51%

Subject 11

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	343	0%	0%
HANGAR	0	1	5	341	1.76%	4.42%
1G1	0	0	9	330	2.73%	7.41%
4G	0	0	2	151	1.32%	2.94%
1G2	0	0	4	346	1.16%	3.51%

Subject 12

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	336	0%	0%
HANGAR	0	0	1	346	0.29%	0.88%
1G1	0	0	3	343	0.87%	2.65%
4G	2	0	2	155	2.58%	1.41%
1G2	0	0	4	346	1.16%	3.51%

APPENDIX D (Continued)

models-8khz / WTW=-50

	INS	DEL	SUB	WORDS	WER	
LAB	0	1	46	3805	1.24%	1.5%
HANGAR	2	4	59	3781	1.72%	
1G1	1	1	44	3876	1.19%	2.5%
4G	13	8	84	1760	5.97%	
1G2	9	3	72	3931	2.14%	
Totals	25	17	305	17153	2.02%	

Subject	LAB	HANGAR	1G1	4G	1G2
1	2.60%	4.35%	4.34%	19.11%	4.36%
2	2.31%	0.89%	0.58%	11.92%	6.75%
3	0.29%	0.00%	0.00%	1.90%	1.99%
4	1.14%	2.02%	1.10%	2.55%	0.80%
5	2.06%	2.05%	1.16%	8.67%	2.02%
6	0.58%	1.16%	1.75%	2.60%	1.45%
7	0.58%	0.00%	0.00%	1.95%	0.00%
8	0.29%	0.87%	0.87%	4.55%	0.29%
9	0.00%	0.29%	0.00%	2.94%	2.22%
10	2.31%	4.66%	0.59%	7.24%	2.03%
11	1.46%	2.64%	3.03%	3.97%	2.02%
12	1.19%	0.58%	0.87%	5.81%	2.02%

English-8K-030502 / WTW=-50

	INS	DEL	SUB	WORDS	WER	
LAB	6	0	13	3805	0.50%	0.8%
HANGAR	3	2	39	3781	1.16%	
1G1	0	1	34	3876	0.90%	1.5%
4G	6	5	33	1760	2.50%	
1G2	0	4	56	3931	1.53%	
Totals	15	12	175	17153	1.18%	

Subject	LAB	HANGAR	1G1	4G	1G2
1	0.29%	2.90%	2.60%	3.18%	3.20%
2	1.45%	1.18%	2.34%	6.62%	5.52%
3	0.29%	0.26%	0.00%	3.81%	1.11%
4	0.00%	0.87%	0.55%	2.55%	0.53%
5	0.29%	1.76%	0.58%	4.00%	0.87%
6	0.00%	0.29%	0.29%	1.95%	0.58%
7	0.00%	0.00%	0.00%	0.00%	0.29%
8	0.00%	0.00%	0.29%	0.00%	0.29%
9	1.14%	0.29%	0.29%	1.76%	1.67%
10	2.02%	4.37%	0.59%	2.63%	1.16%
11	0.00%	0.88%	2.73%	0.66%	2.02%
12	0.00%	0.58%	0.58%	6.45%	1.16%

APPENDIX D (Continued)

models-8khz, WTW=-50

Subject 1

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	9	346	2.60%	7.89%
HANGAR	0	1	14	345	4.35%	10.62%
1G1	0	0	15	346	4.34%	13.16%
4G	9	2	19	157	19.11%	18.31%
1G2	3	0	12	344	4.36%	9.73%

Subject 2

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	8	346	2.31%	7.02%
HANGAR	0	0	3	338	0.89%	2.70%
1G1	0	0	2	342	0.58%	1.79%
4G	1	3	14	151	11.92%	11.59%
1G2	4	2	16	326	6.75%	9.91%

Subject 3

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	346	0.29%	0.88%
HANGAR	0	0	0	383	0%	0%
1G1	0	0	0	426	0.00%	0.00%
4G	0	0	4	210	1.90%	4.12%
1G2	0	0	9	452	1.99%	6.43%

Subject 4

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	4	351	1.14%	3.48%
HANGAR	0	0	7	346	2.02%	6.14%
1G1	0	0	4	365	1.10%	3.39%
4G	0	0	4	157	2.55%	5.63%
1G2	0	0	3	374	0.80%	2.50%

Subject 5

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	7	339	2.06%	6.31%
HANGAR	0	0	7	341	2.05%	6.25%
1G1	0	1	3	346	1.16%	3.51%
4G	0	2	11	150	8.67%	13.24%
1G2	1	0	6	346	2.02%	3.51%

Subject 6

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	2	344	0.58%	1.77%
HANGAR	0	0	4	346	1.16%	3.51%
1G1	1	0	5	343	1.75%	3.54%
4G	0	0	4	154	2.60%	5.71%
1G2	0	1	4	346	1.45%	2.63%

Subject 7

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	2	346	0.58%	1.75%
HANGAR	0	0	0	306	0%	0%
1G1	0	0	0	347	0%	0%
4G	0	0	3	154	1.95%	4.29%
1G2	0	0	0	346	0%	0%

Subject 8

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	346	0.29%	0.88%
HANGAR	0	0	3	346	0.87%	2.63%
1G1	0	0	3	346	0.87%	2.63%
4G	1	0	6	154	4.55%	7.14%
1G2	0	0	1	346	0.29%	0.88%

Subject 9

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	352	0%	0%
HANGAR	0	0	1	346	0.29%	0.88%
1G1	0	0	0	346	0%	0%
4G	0	0	5	170	2.94%	6.41%
1G2	0	0	8	360	2.22%	6.78%

Subject 10

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	1	7	346	2.31%	5.26%
HANGAR	2	2	12	343	4.66%	11.50%
1G1	0	0	2	339	0.59%	1.79%
4G	0	1	10	152	7.24%	13.04%
1G2	1	0	6	345	2.03%	4.39%

Subject 11

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	5	343	1.46%	4.42%
HANGAR	0	1	8	341	2.64%	5.31%
1G1	0	0	10	330	3.03%	8.33%
4G	2	0	4	151	3.97%	4.41%
1G2	0	0	7	346	2.02%	6.14%

Subject 12

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	4	336	1.19%	3.57%
HANGAR	0	0	2	346	0.58%	1.75%
1G1	0	0	3	343	0.87%	2.65%
4G	2	0	7	155	5.81%	8.45%
1G2	0	0	7	346	2.02%	5.26%

APPENDIX D (Continued)

English-8K-030502, WTW=-50

Subject 1

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	0	0	346	0.29%	0.88%
HANGAR	2	0	8	345	2.90%	6.19%
1G1	0	0	9	346	2.60%	7.89%
4G	0	1	4	157	3.18%	5.63%
1G2	0	1	10	344	3.20%	7.08%

Subject 2

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	0	4	346	1.45%	4.39%
HANGAR	0	0	4	338	1.18%	2.70%
1G1	0	0	8	342	2.34%	7.14%
4G	3	0	7	151	6.62%	5.80%
1G2	0	2	16	326	5.52%	11.71%

Subject 3

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	346	0.29%	0.88%
HANGAR	0	0	1	383	0.26%	0.81%
1G1	0	0	0	426	0%	0%
4G	3	0	5	210	3.81%	4.12%
1G2	0	0	5	452	1.11%	3.57%

Subject 4

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	351	0%	0%
HANGAR	0	0	3	346	0.87%	2.63%
1G1	0	0	2	365	0.55%	1.69%
4G	0	0	4	157	2.55%	5.63%
1G2	0	0	2	374	0.53%	1.67%

Subject 5

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	339	0.29%	0.90%
HANGAR	0	0	6	341	1.76%	5.36%
1G1	0	1	1	346	0.58%	1.75%
4G	0	2	4	150	4%	5.88%
1G2	0	0	3	346	0.87%	2.63%

Subject 6

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	344	0%	0%
HANGAR	0	0	1	346	0.29%	0.88%
1G1	0	0	1	343	0.29%	0.88%
4G	0	2	1	154	1.95%	1.43%
1G2	0	0	2	346	0.58%	1.75%

Subject 7

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	346	0%	0%
HANGAR	0	0	0	306	0%	0%
1G1	0	0	0	347	0%	0%
4G	0	0	0	154	0%	0%
1G2	0	0	1	346	0.29%	0.88%

Subject 8

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	346	0%	0%
HANGAR	0	0	0	346	0%	0%
1G1	0	0	1	346	0.29%	0.88%
4G	0	0	0	154	0%	0%
1G2	0	0	1	346	0.29%	0.88%

Subject 9

	INS	DEL	SUB	WORDS	WER	SER
LAB	3	0	1	352	1.14%	1.72%
HANGAR	0	0	1	346	0.29%	0.88%
1G1	0	0	1	346	0.29%	0.88%
4G	0	0	3	170	1.76%	3.85%
1G2	0	0	6	360	1.67%	5.08%

Subject 10

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	0	6	346	2.02%	5.26%
HANGAR	1	2	12	343	4.37%	8.85%
1G1	0	0	2	339	0.59%	1.79%
4G	0	0	4	152	2.63%	5.80%
1G2	0	1	3	345	1.16%	2.63%

Subject 11

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	343	0%	0%
HANGAR	0	0	3	341	0.88%	2.65%
1G1	0	0	9	330	2.73%	7.41%
4G	0	0	1	151	0.66%	1.47%
1G2	0	0	7	346	2.02%	5.26%

Subject 12

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	336	0%	0%
HANGAR	0	0	2	346	0.58%	1.75%
1G1	0	0	2	343	0.58%	1.77%
4G	6	0	4	155	6.45%	4.23%
1G2	0	0	4	346	1.16%	3.51%

APPENDIX D (Continued)

models-8khz / WTW=0

	INS	DEL	SUB	WORDS	WER	
LAB	3	1	46	3805	1.31%	1.6%
HANGAR	10	3	58	3781	1.88%	
1G1	9	0	55	3876	1.65%	2.8%
4G	22	3	85	1760	6.25%	
1G2	9	2	80	3931	2.31%	
Totals	53	9	324	17153	2.25%	

Subject	LAB	HANGAR	1G1	4G	1G2
1	4.05%	5.22%	6.07%	23.57%	4.65%
2	2.31%	1.78%	0.58%	15.23%	6.44%
3	0.29%	0.00%	0.47%	1.43%	2.43%
4	0.85%	1.73%	1.37%	2.55%	0.80%
5	2.06%	2.05%	1.16%	8.00%	2.02%
6	0.87%	1.16%	3.21%	2.60%	1.45%
7	0.29%	0.00%	0.00%	1.30%	0.00%
8	0.00%	0.58%	0.58%	4.55%	0.29%
9	0.00%	1.45%	0.29%	2.94%	2.78%
10	2.31%	4.37%	0.59%	4.61%	2.03%
11	1.46%	2.35%	4.24%	3.97%	2.89%
12	1.19%	0.58%	0.87%	9.03%	1.73%

English-8K-030502 / WTW=0

	INS	DEL	SUB	WORDS	WER	
LAB	6	0	13	3805	0.50%	0.8%
HANGAR	3	2	40	3781	1.19%	
1G1	0	1	34	3876	0.90%	1.5%
4G	9	5	34	1760	2.73%	
1G2	0	4	61	3931	1.65%	
Totals	18	12	182	17153	1.24%	

Subject	LAB	HANGAR	1G1	4G	1G2
1	0.29%	2.61%	2.60%	2.55%	4.07%
2	1.45%	0.89%	2.05%	9.27%	5.83%
3	0.29%	0.78%	0.00%	4.29%	1.33%
4	0.00%	0.58%	0.82%	1.91%	0.53%
5	0.29%	2.35%	0.87%	4.00%	0.58%
6	0.00%	0.29%	0.29%	1.95%	0.58%
7	0.00%	0.00%	0.00%	0.00%	0.29%
8	0.00%	0.00%	0.29%	0.00%	0.29%
9	1.14%	0.29%	0.29%	1.76%	2.22%
10	2.02%	4.37%	0.29%	2.63%	0.87%
11	0.00%	0.88%	2.73%	1.32%	2.02%
12	0.00%	0.58%	0.29%	5.81%	1.16%

APPENDIX D (Continued)

models-8khz, WTW=0

Subject 1

	INS	DEL	SUB	WORDS	WER	SER
LAB	3	0	11	346	4.05%	8.77%
HANGAR	3	1	14	345	5.22%	10.62%
1G1	3	0	18	346	6.07%	14.04%
4G	14	1	22	157	23.57%	21.13%
1G2	3	0	13	344	4.65%	10.62%

Subject 2

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	8	346	2.31%	7.02%
HANGAR	2	0	4	338	1.78%	2.70%
1G1	0	0	2	342	0.58%	1.79%
4G	5	0	18	151	15.23%	13.04%
1G2	4	1	16	326	6.44%	9.91%

Subject 3

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	346	0.29%	0.88%
HANGAR	0	0	0	383	0%	0%
1G1	0	0	2	426	0.47%	1.46%
4G	0	0	3	210	1.43%	3.09%
1G2	0	0	11	452	2.43%	7.86%

Subject 4

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	3	351	0.85%	2.61%
HANGAR	0	0	6	346	1.73%	5.26%
1G1	0	0	5	365	1.37%	4.24%
4G	0	0	4	157	2.55%	5.63%
1G2	0	0	3	374	0.80%	2.50%

Subject 5

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	7	339	2.06%	6.31%
HANGAR	0	0	7	341	2.05%	6.25%
1G1	0	0	4	346	1.16%	3.51%
4G	0	2	10	150	8%	11.76%
1G2	1	0	6	346	2.02%	3.51%

Subject 6

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	3	344	0.87%	2.65%
HANGAR	0	0	4	346	1.16%	3.51%
1G1	4	0	7	343	3.21%	4.42%
4G	0	0	4	154	2.60%	5.71%
1G2	0	1	4	346	1.45%	2.63%

Subject 7

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	346	0.29%	0.88%
HANGAR	0	0	0	306	0%	0%
1G1	0	0	0	347	0%	0%
4G	0	0	2	154	1.30%	2.86%
1G2	0	0	0	346	0%	0%

Subject 8

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	346	0%	0%
HANGAR	0	0	2	346	0.58%	1.75%
1G1	0	0	2	346	0.58%	1.75%
4G	1	0	6	154	4.55%	7.14%
1G2	0	0	1	346	0.29%	0.88%

Subject 9

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	352	0%	0%
HANGAR	2	0	3	346	1.45%	1.75%
1G1	0	0	1	346	0.29%	0.88%
4G	0	0	5	170	2.94%	6.41%
1G2	0	0	10	360	2.78%	8.47%

Subject 10

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	1	7	346	2.31%	5.26%
HANGAR	3	1	11	343	4.37%	10.62%
1G1	0	0	2	339	0.59%	1.79%
4G	0	0	7	152	4.61%	10.14%
1G2	1	0	6	345	2.03%	4.39%

Subject 11

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	5	343	1.46%	4.42%
HANGAR	0	1	7	341	2.35%	4.42%
1G1	2	0	12	330	4.24%	9.26%
4G	2	0	4	151	3.97%	4.41%
1G2	0	0	10	346	2.89%	8.77%

Subject 12

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	4	336	1.19%	3.57%
HANGAR	0	0	2	346	0.58%	1.75%
1G1	0	0	3	343	0.87%	2.65%
4G	6	0	8	155	9.03%	9.86%
1G2	0	0	6	346	1.73%	4.39%

APPENDIX D (Continued)

English-8K-030502, WTW=0

Subject 1

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	0	0	346	0.29%	0.88%
HANGAR	2	0	7	345	2.61%	5.31%
1G1	0	0	9	346	2.60%	7.89%
4G	0	1	3	157	2.55%	4.23%
1G2	0	1	13	344	4.07%	8.85%

Subject 2

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	0	4	346	1.45%	4.39%
HANGAR	0	0	3	338	0.89%	2.70%
1G1	0	0	7	342	2.05%	6.25%
4G	5	0	9	151	9.27%	7.25%
1G2	0	2	17	326	5.83%	10.81%

Subject 3

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	346	0.29%	0.88%
HANGAR	0	0	3	383	0.78%	2.44%
1G1	0	0	0	426	0%	0%
4G	4	0	5	210	4.29%	4.12%
1G2	0	0	6	452	1.33%	4.29%

Subject 4

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	351	0%	0%
HANGAR	0	0	2	346	0.58%	1.75%
1G1	0	0	3	365	0.82%	2.54%
4G	0	0	3	157	1.91%	4.23%
1G2	0	0	2	374	0.53%	1.67%

Subject 5

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	339	0.29%	0.90%
HANGAR	0	0	8	341	2.35%	7.14%
1G1	0	1	2	346	0.87%	2.63%
4G	0	2	4	150	4%	5.88%
1G2	0	0	2	346	0.58%	1.75%

Subject 6

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	344	0%	0%
HANGAR	0	0	1	346	0.29%	0.88%
1G1	0	0	1	343	0.29%	0.88%
4G	0	2	1	154	1.95%	1.43%
1G2	0	0	2	346	0.58%	1.75%

Subject 7

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	346	0%	0%
HANGAR	0	0	0	306	0%	0%
1G1	0	0	0	347	0%	0%
4G	0	0	0	154	0%	0%
1G2	0	0	1	346	0.29%	0.88%

Subject 8

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	346	0%	0%
HANGAR	0	0	0	346	0%	0%
1G1	0	0	1	346	0.29%	0.88%
4G	0	0	0	154	0%	0%
1G2	0	0	1	346	0.29%	0.88%

Subject 9

	INS	DEL	SUB	WORDS	WER	SER
LAB	3	0	1	352	1.14%	1.72%
HANGAR	0	0	1	346	0.29%	0.88%
1G1	0	0	1	346	0.29%	0.88%
4G	0	0	3	170	1.76%	3.85%
1G2	0	0	8	360	2.22%	6.78%

Subject 10

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	0	6	346	2.02%	6.14%
HANGAR	1	2	12	343	4.37%	8.85%
1G1	0	0	1	339	0.29%	0.89%
4G	0	0	4	152	2.63%	5.80%
1G2	0	1	2	345	0.87%	1.75%

Subject 11

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	343	0%	0%
HANGAR	0	0	3	341	0.88%	2.65%
1G1	0	0	9	330	2.73%	7.41%
4G	0	0	2	151	1.32%	2.94%
1G2	0	0	7	346	2.02%	6.14%

Subject 12

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	336	0%	0%
HANGAR	0	0	2	346	0.58%	1.75%
1G1	0	0	1	343	0.29%	0.88%
4G	6	0	3	155	5.81%	2.82%
1G2	0	0	4	346	1.16%	3.51%

APPENDIX D (Continued)

models-8khz / WTW=50

	INS	DEL	SUB	WORDS	WER	
LAB	13	0	51	3805	1.68%	1.9%
HANGAR	16	2	61	3781	2.09%	
1G1	12	0	55	3876	1.73%	3.1%
4G	36	2	92	1760	7.39%	
1G2	15	1	81	3931	2.47%	
Totals	92	5	340	17153	2.55%	

Subject	LAB	HANGAR	1G1	4G	1G2
1	5.20%	4.64%	7.51%	22.29%	4.36%
2	2.60%	1.78%	0.58%	17.88%	6.75%
3	0.29%	0.00%	0.70%	2.38%	3.76%
4	0.57%	1.16%	1.10%	2.55%	0.80%
5	2.95%	2.93%	1.16%	7.33%	2.89%
6	2.03%	2.60%	2.92%	12.34%	0.58%
7	0.29%	0.00%	0.00%	1.30%	0.00%
8	0.29%	0.58%	0.87%	5.84%	0.29%
9	0.00%	1.45%	0.00%	2.94%	3.06%
10	1.73%	5.25%	0.59%	4.61%	2.03%
11	2.62%	2.64%	3.94%	3.97%	2.60%
12	1.19%	0.58%	0.87%	9.03%	2.02%

English-8K-030502 / WTW=50

	INS	DEL	SUB	WORDS	WER	
LAB	3	0	12	3805	0.39%	0.8%
HANGAR	3	2	39	3781	1.16%	
1G1	0	1	38	3876	1.01%	1.8%
4G	14	5	41	1760	3.41%	
1G2	6	2	68	3931	1.93%	
Totals	26	10	198	17153	1.36%	

Subject	LAB	HANGAR	1G1	4G	1G2
1	0.29%	3.77%	3.47%	8.28%	4.94%
2	1.45%	0.59%	2.05%	10.60%	7.06%
3	0.29%	0.78%	0.47%	5.24%	1.77%
4	0.00%	0.29%	0.82%	2.55%	0.53%
5	0.29%	1.47%	0.58%	3.33%	0.29%
6	0.29%	0.29%	0.29%	1.95%	0.87%
7	0.00%	0.00%	0.00%	0.00%	0.29%
8	0.00%	0.00%	0.29%	0.00%	0.29%
9	0.00%	0.29%	0.29%	1.76%	2.22%
10	1.73%	4.08%	0.29%	2.63%	1.16%
11	0.00%	1.17%	2.73%	0.66%	2.31%
12	0.00%	0.29%	0.29%	5.81%	0.87%

APPENDIX D (Continued)

models-8khz, WTW=50

Subject 1.

	INS	DEL	SUB	WORDS	WER	SER
LAB	7	0	11	346	5.20%	7.02%
HANGAR	3	0	13	345	4.64%	10.62%
1G1	6	0	20	346	7.51%	14.91%
4G	15	0	20	157	22.29%	18.31%
1G2	3	0	12	344	4.36%	9.73%

Subject 2

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	9	346	2.60%	7.89%
HANGAR	2	0	4	338	1.78%	2.70%
1G1	0	0	2	342	0.58%	1.79%
4G	7	0	20	151	17.88%	14.49%
1G2	5	1	16	326	6.75%	9.91%

Subject 3

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	346	0.29%	0.88%
HANGAR	0	0	0	383	0%	0%
1G1	0	0	3	426	0.70%	2.19%
4G	1	0	4	210	2.38%	4.12%
1G2	3	0	14	452	3.76%	9.29%

Subject 4

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	2	351	0.57%	1.74%
HANGAR	0	0	4	346	1.16%	3.51%
1G1	0	0	4	365	1.10%	3.39%
4G	0	0	4	157	2.55%	5.63%
1G2	0	0	3	374	0.80%	2.50%

Subject 5

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	0	9	339	2.95%	8.11%
HANGAR	1	0	9	341	2.93%	7.14%
1G1	0	0	4	346	1.16%	3.51%
4G	0	2	9	150	7.33%	10.29%
1G2	3	0	7	346	2.89%	5.26%

Subject 6

	INS	DEL	SUB	WORDS	WER	SER
LAB	3	0	4	344	2.03%	2.65%
HANGAR	3	0	6	346	2.60%	4.39%
1G1	4	0	6	343	2.92%	3.54%
4G	9	0	10	154	12.34%	10%
1G2	0	0	2	346	0.58%	1.75%

Subject 7

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	346	0.29%	0.88%
HANGAR	0	0	0	306	0%	0%
1G1	0	0	0	347	0%	0%
4G	0	0	2	154	1.30%	2.86%
1G2	0	0	0	346	0%	0%

Subject 8

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	346	0.29%	0.88%
HANGAR	0	0	2	346	0.58%	1.75%
1G1	0	0	3	346	0.87%	2.63%
4G	2	0	7	154	5.84%	7.14%
1G2	0	0	1	346	0.29%	0.88%

Subject 9

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	352	0%	0%
HANGAR	2	0	3	346	1.45%	1.75%
1G1	0	0	0	346	0%	0%
4G	0	0	5	170	2.94%	6.41%
1G2	0	0	11	360	3.06%	9.32%

Subject 10

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	6	346	1.73%	5.26%
HANGAR	5	1	12	343	5.25%	10.62%
1G1	0	0	2	339	0.59%	1.79%
4G	0	0	7	152	4.61%	10.14%
1G2	1	0	6	345	2.03%	4.39%

Subject 11

	INS	DEL	SUB	WORDS	WER	SER
LAB	2	0	7	343	2.62%	5.31%
HANGAR	0	1	8	341	2.64%	5.31%
1G1	2	0	11	330	3.94%	8.33%
4G	2	0	4	151	3.97%	4.41%
1G2	0	0	9	346	2.60%	7.89%

Subject 12

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	4	336	1.19%	3.57%
HANGAR	0	0	2	346	0.58%	1.75%
1G1	0	0	3	343	0.87%	2.65%
4G	6	0	8	155	9.03%	9.86%
1G2	0	0	7	346	2.02%	5.26%

APPENDIX D (Continued)

English-8K-030502, WTW=50

Subject 1

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	0	0	346	0.29%	0.88%
HANGAR	2	0	11	345	3.77%	8.85%
1G1	0	0	12	346	3.47%	10.53%
4G	3	1	9	157	8.28%	8.45%
1G2	3	0	14	344	4.94%	10.62%

Subject 2

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	0	4	346	1.45%	3.51%
HANGAR	0	0	2	338	0.59%	1.80%
1G1	0	0	7	342	2.05%	6.25%
4G	7	0	9	151	10.60%	7.25%
1G2	3	1	19	326	7.06%	11.71%

Subject 3

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	346	0.29%	0.88%
HANGAR	0	0	3	383	0.78%	2.44%
1G1	0	0	2	426	0.47%	1.46%
4G	4	0	7	210	5.24%	6.19%
1G2	0	0	8	452	1.77%	5.71%

Subject 4

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	351	0%	0%
HANGAR	0	0	1	346	0.29%	0.88%
1G1	0	0	3	365	0.82%	2.54%
4G	0	0	4	157	2.55%	5.63%
1G2	0	0	2	374	0.53%	1.67%

Subject 5

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	339	0.29%	0.90%
HANGAR	0	0	5	341	1.47%	4.46%
1G1	0	1	1	346	0.58%	1.75%
4G	0	2	3	150	3.33%	4.41%
1G2	0	0	1	346	0.29%	0.88%

Subject 6

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	344	0.29%	0.88%
HANGAR	0	0	1	346	0.29%	0.88%
1G1	0	0	1	343	0.29%	0.88%
4G	0	2	1	154	1.95%	1.43%
1G2	0	0	3	346	0.87%	2.63%

Subject 7

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	346	0%	0%
HANGAR	0	0	0	306	0%	0%
1G1	0	0	0	347	0%	0%
4G	0	0	0	154	0%	0%
1G2	0	0	1	346	0.29%	0.88%

Subject 8

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	346	0%	0%
HANGAR	0	0	0	346	0%	0%
1G1	0	0	1	346	0.29%	0.88%
4G	0	0	0	154	0%	0%
1G2	0	0	1	346	0.29%	0.88%

Subject 9

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	352	0%	0%
HANGAR	0	0	1	346	0.29%	0.88%
1G1	0	0	1	346	0.29%	0.88%
4G	0	0	3	170	1.76%	3.85%
1G2	0	0	8	360	2.22%	6.78%

Subject 10

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	0	5	346	1.73%	5.26%
HANGAR	1	2	11	343	4.08%	7.96%
1G1	0	0	1	339	0.29%	0.89%
4G	0	0	4	152	2.63%	5.80%
1G2	0	1	3	345	1.16%	2.63%

Subject 11

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	343	0%	0%
HANGAR	0	0	4	341	1.17%	3.54%
1G1	0	0	9	330	2.73%	7.41%
4G	0	0	1	151	0.66%	1.47%
1G2	0	0	8	346	2.31%	7.02%

Subject 12

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	336	0%	0%
HANGAR	0	0	1	346	0.29%	0.88%
1G1	0	0	1	343	0.29%	0.88%
4G	6	0	3	155	5.81%	2.82%
1G2	0	0	3	346	0.87%	2.63%

APPENDIX D (Continued)

models-8khz / WTW=100

	INS	DEL	SUB	WORDS	WER	
LAB	26	0	58	3805	2.21%	2.5%
HANGAR	27	1	74	3781	2.70%	
1G1	21	0	67	3876	2.27%	4.3%
4G	68	1	120	1760	10.74%	
1G2	34	0	104	3931	3.51%	
Totals	176	2	423	17153	3.50%	

Subject	LAB	HANGAR	1G1	4G	1G2
1	8.38%	6.38%	7.51%	28.03%	7.85%
2	2.31%	3.25%	1.75%	29.80%	7.67%
3	0.29%	0.00%	1.41%	3.81%	5.97%
4	0.57%	1.16%	1.37%	3.18%	0.80%
5	3.24%	3.23%	1.73%	15.33%	3.18%
6	2.03%	2.31%	4.66%	12.99%	2.02%
7	0.29%	0.00%	0.00%	1.30%	0.00%
8	0.29%	0.58%	0.87%	8.44%	0.29%
9	0.85%	1.45%	0.29%	4.12%	4.17%
10	3.47%	7.00%	0.59%	7.89%	2.32%
11	2.62%	4.40%	5.15%	6.62%	4.05%
12	1.19%	0.58%	0.87%	9.68%	2.02%

English-8K-030502 / WTW=100

	INS	DEL	SUB	WORDS	WER	
LAB	3	0	17	3805	0.53%	1.0%
HANGAR	7	0	48	3781	1.45%	
1G1	7	1	48	3876	1.44%	3.0%
4G	35	4	73	1760	6.36%	
1G2	19	3	93	3931	2.93%	
Totals	71	8	279	17153	2.09%	

Subject	LAB	HANGAR	1G1	4G	1G2
1	1.16%	4.06%	4.62%	21.66%	5.81%
2	1.73%	0.89%	2.34%	19.87%	8.59%
3	0.29%	1.31%	0.94%	6.19%	4.87%
4	0.00%	0.29%	0.82%	3.18%	0.53%
5	0.29%	2.64%	2.31%	6.00%	0.58%
6	0.29%	0.29%	0.29%	4.55%	2.31%
7	0.00%	0.33%	0.00%	0.65%	0.29%
8	0.00%	0.00%	0.29%	0.00%	0.29%
9	0.00%	0.58%	0.29%	1.76%	3.89%
10	2.02%	3.21%	1.18%	5.26%	2.03%
11	0.00%	2.35%	3.03%	1.32%	2.89%
12	0.00%	0.00%	0.29%	6.45%	0.87%

APPENDIX D (Continued)

models-8khz, WTW=100

Subject 1

	INS	DEL	SUB	WORDS	WER	SER
LAB	14	0	15	346	8.38%	9.65%
HANGAR	6	0	16	345	6.38%	11.50%
1G1	6	0	20	346	7.51%	14.91%
4G	21	0	23	157	28.03%	19.72%
1G2	9	0	18	344	7.85%	13.27%

Subject 2

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	8	346	2.31%	7.02%
HANGAR	4	0	7	338	3.25%	4.50%
1G1	2	0	4	342	1.75%	2.68%
4G	17	0	28	151	29.80%	18.84%
1G2	7	0	18	326	7.67%	9.91%

Subject 3

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	346	0.29%	0.88%
HANGAR	0	0	0	383	0%	0%
1G1	0	0	6	426	1.41%	4.38%
4G	1	0	7	210	3.81%	6.19%
1G2	7	0	20	452	5.97%	12.86%

Subject 4

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	2	351	0.57%	1.74%
HANGAR	0	0	4	346	1.16%	3.51%
1G1	0	0	5	365	1.37%	4.24%
4G	0	0	5	157	3.18%	7.04%
1G2	0	0	3	374	0.80%	2.50%

Subject 5

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	0	10	339	3.24%	9.01%
HANGAR	3	0	8	341	3.23%	6.25%
1G1	2	0	4	346	1.73%	3.51%
4G	6	1	16	150	15.33%	14.71%
1G2	3	0	8	346	3.18%	5.26%

Subject 6

	INS	DEL	SUB	WORDS	WER	SER
LAB	3	0	4	344	2.03%	2.65%
HANGAR	3	0	5	346	2.31%	3.51%
1G1	7	0	9	343	4.66%	5.31%
4G	9	0	11	154	12.99%	11.43%
1G2	3	0	4	346	2.02%	2.63%

Subject 7

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	346	0.29%	0.88%
HANGAR	0	0	0	306	0%	0%
1G1	0	0	0	347	0%	0%
4G	0	0	2	154	1.30%	2.86%
1G2	0	0	0	346	0%	0%

Subject 8

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	346	0.29%	0.88%
HANGAR	0	0	2	346	0.58%	1.75%
1G1	0	0	3	346	0.87%	2.63%
4G	5	0	8	154	8.44%	7.14%
1G2	0	0	1	346	0.29%	0.88%

Subject 9

	INS	DEL	SUB	WORDS	WER	SER
LAB	2	0	1	352	0.85%	0.86%
HANGAR	2	0	3	346	1.45%	1.75%
1G1	0	0	1	346	0.29%	0.88%
4G	1	0	6	170	4.12%	7.69%
1G2	2	0	13	360	4.17%	10.17%

Subject 10

	INS	DEL	SUB	WORDS	WER	SER
LAB	4	0	8	346	3.47%	7.02%
HANGAR	7	0	17	343	7%	13.27%
1G1	0	0	2	339	0.59%	1.79%
4G	3	0	9	152	7.89%	11.59%
1G2	1	0	7	345	2.32%	5.26%

Subject 11

	INS	DEL	SUB	WORDS	WER	SER
LAB	2	0	7	343	2.62%	5.31%
HANGAR	2	1	12	341	4.40%	7.96%
1G1	4	0	13	330	5.15%	9.26%
4G	5	0	5	151	6.62%	4.41%
1G2	2	0	12	346	4.05%	9.65%

Subject 12

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	4	336	1.19%	3.57%
HANGAR	0	0	2	346	0.58%	1.75%
1G1	0	0	3	343	0.87%	2.65%
4G	6	0	9	155	9.68%	11.27%
1G2	0	0	7	346	2.02%	5.26%

APPENDIX D (Continued)

English-8K-030502, WTW=100

Subject 1

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	0	3	346	1.16%	1.75%
HANGAR	2	0	12	345	4.06%	9.73%
1G1	1	0	15	346	4.62%	13.16%
4G	14	0	20	157	21.66%	15.49%
1G2	3	0	17	344	5.81%	13.27%

Subject 7

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	346	0%	0%
HANGAR	0	0	1	306	0.33%	0.99%
1G1	0	0	0	347	0%	0%
4G	0	0	1	154	0.65%	1.43%
1G2	0	0	1	346	0.29%	0.88%

Subject 2

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	0	5	346	1.73%	4.39%
HANGAR	0	0	3	338	0.89%	2.70%
1G1	1	0	7	342	2.34%	6.25%
4G	14	0	16	151	19.87%	14.49%
1G2	5	1	22	326	8.59%	14.41%

Subject 8

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	346	0%	0%
HANGAR	0	0	0	346	0%	0%
1G1	0	0	1	346	0.29%	0.88%
4G	0	0	0	154	0%	0%
1G2	0	0	1	346	0.29%	0.88%

Subject 3

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	346	0.29%	0.88%
HANGAR	0	0	5	383	1.31%	4.07%
1G1	0	0	4	426	0.94%	2.92%
4G	5	0	8	210	6.19%	7.22%
1G2	6	0	16	452	4.87%	10%

Subject 9

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	352	0%	0%
HANGAR	0	0	2	346	0.58%	1.75%
1G1	0	0	1	346	0.29%	0.88%
4G	0	0	3	170	1.76%	3.85%
1G2	1	1	12	360	3.89%	11.02%

Subject 4

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	351	0%	0%
HANGAR	0	0	1	346	0.29%	0.88%
1G1	0	0	3	365	0.82%	2.54%
4G	0	0	5	157	3.18%	7.04%
1G2	0	0	2	374	0.53%	1.67%

Subject 10

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	0	6	346	2.02%	4.39%
HANGAR	2	0	9	343	3.21%	7.08%
1G1	2	0	2	339	1.18%	1.79%
4G	1	0	7	152	5.26%	7.25%
1G2	1	1	5	345	2.03%	4.39%

Subject 5

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	339	0.29%	0.90%
HANGAR	3	0	6	341	2.64%	4.46%
1G1	3	1	4	346	2.31%	3.51%
4G	0	2	7	150	6%	8.82%
1G2	0	0	2	346	0.58%	1.75%

Subject 11

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	343	0%	0%
HANGAR	0	0	8	341	2.35%	7.08%
1G1	0	0	10	330	3.03%	8.33%
4G	0	0	2	151	1.32%	2.94%
1G2	0	0	10	346	2.89%	8.77%

Subject 6

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	344	0.29%	0.88%
HANGAR	0	0	1	346	0.29%	0.88%
1G1	0	0	1	343	0.29%	0.88%
4G	1	2	4	154	4.55%	4.29%
1G2	3	0	5	346	2.31%	3.51%

Subject 12

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	336	0%	0%
HANGAR	0	0	0	346	0%	0%
1G1	0	0	1	343	0.29%	0.88%
4G	6	0	4	155	6.45%	4.23%
1G2	0	0	3	346	0.87%	2.63%

APPENDIX D (Continued)

models-8khz / WTW=150

	INS	DEL	SUB	WORDS	WER	
LAB	64	0	90	3805	4.05%	4.2%
HANGAR	55	1	106	3781	4.28%	
1G1	33	0	86	3876	3.07%	6.0%
4G	96	2	158	1760	14.55%	
1G2	61	1	138	3931	5.09%	
Totals	309	4	578	17153	5.19%	

Subject	LAB	HANGAR	1G1	4G	1G2
1	13.29%	11.01%	10.40%	39.49%	10.47%
2	4.91%	4.73%	1.75%	35.10%	10.43%
3	1.73%	2.35%	1.64%	6.19%	7.52%
4	0.57%	2.31%	1.64%	3.18%	0.80%
5	2.95%	5.28%	2.02%	22.67%	2.60%
6	6.69%	4.05%	4.37%	14.94%	6.65%
7	1.73%	0.00%	0.00%	1.95%	0.00%
8	0.29%	1.73%	0.87%	8.44%	0.87%
9	2.27%	2.31%	1.73%	7.06%	4.72%
10	6.07%	7.87%	0.59%	13.82%	4.35%
11	4.08%	5.28%	9.39%	11.26%	7.51%
12	1.49%	1.45%	2.04%	10.32%	2.02%

English-8K-030502 / WTW=150

	INS	DEL	SUB	WORDS	WER	
LAB	17	0	50	3805	1.76%	2.5%
HANGAR	24	2	93	3781	3.15%	
1G1	18	2	78	3876	2.53%	6.1%
4G	85	6	183	1760	15.57%	
1G2	46	7	154	3931	5.27%	
Totals	190	17	558	17153	4.46%	

Subject	LAB	HANGAR	1G1	4G	1G2
1	4.05%	6.38%	11.27%	40.13%	10.47%
2	1.73%	0.59%	2.92%	33.77%	17.18%
3	2.02%	5.48%	1.17%	24.76%	7.74%
4	1.99%	1.73%	0.82%	4.46%	1.87%
5	2.06%	6.16%	2.60%	20.67%	1.45%
6	0.29%	0.87%	1.75%	12.99%	3.47%
7	0.29%	0.33%	0.00%	1.30%	0.58%
8	0.29%	0.00%	0.29%	3.25%	0.00%
9	0.00%	0.58%	1.16%	1.76%	6.39%
10	6.07%	8.45%	1.47%	14.47%	4.35%
11	0.58%	3.52%	4.85%	11.92%	4.62%
12	0.00%	0.87%	1.75%	6.45%	2.31%

APPENDIX D (Continued)

models-8khz, WTW=150

Subject 1

	INS	DEL	SUB	WORDS	WER	SER
LAB	23	0	23	346	13.29%	13.16%
HANGAR	13	0	25	345	11.01%	17.70%
1G1	10	0	26	346	10.40%	19.30%
4G	29	1	32	157	39.49%	26.76%
1G2	13	0	23	344	10.47%	16.81%

Subject 2

	INS	DEL	SUB	WORDS	WER	SER
LAB	5	0	12	346	4.91%	7.89%
HANGAR	7	0	9	338	4.73%	5.41%
1G1	2	0	4	342	1.75%	2.68%
4G	21	0	32	151	35.10%	23.19%
1G2	9	1	24	326	10.43%	12.61%

Subject 3

	INS	DEL	SUB	WORDS	WER	SER
LAB	3	0	3	346	1.73%	1.75%
HANGAR	3	0	6	383	2.35%	4.07%
1G1	0	0	7	426	1.64%	5.11%
4G	4	0	9	210	6.19%	7.22%
1G2	9	0	25	452	7.52%	15.71%

Subject 4

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	2	351	0.57%	1.74%
HANGAR	2	0	6	346	2.31%	5.26%
1G1	0	0	6	365	1.64%	5.08%
4G	0	0	5	157	3.18%	7.04%
1G2	0	0	3	374	0.80%	2.50%

Subject 5

	INS	DEL	SUB	WORDS	WER	SER
LAB	1	0	9	339	2.95%	8.11%
HANGAR	6	0	12	341	5.28%	8.93%
1G1	2	0	5	346	2.02%	4.39%
4G	9	1	24	150	22.67%	20.59%
1G2	2	0	7	346	2.60%	6.14%

Subject 6

	INS	DEL	SUB	WORDS	WER	SER
LAB	12	0	11	344	6.69%	6.19%
HANGAR	6	0	8	346	4.05%	5.26%
1G1	7	0	8	343	4.37%	4.42%
4G	11	0	12	154	14.94%	11.43%
1G2	13	0	10	346	6.65%	5.26%

Subject 7

	INS	DEL	SUB	WORDS	WER	SER
LAB	3	0	3	346	1.73%	1.75%
HANGAR	0	0	0	306	0.00%	0.00%
1G1	0	0	0	347	0.00%	0.00%
4G	0	0	3	154	1.95%	4.29%
1G2	0	0	0	346	0.00%	0.00%

Subject 8

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	346	0.29%	0.88%
HANGAR	3	0	3	346	1.73%	1.75%
1G1	0	0	3	346	0.87%	2.63%
4G	5	0	8	154	8.44%	7.14%
1G2	1	0	2	346	0.87%	0.88%

Subject 9

	INS	DEL	SUB	WORDS	WER	SER
LAB	5	0	3	352	2.27%	1.72%
HANGAR	4	0	4	346	2.31%	2.63%
1G1	2	0	4	346	1.73%	2.63%
4G	2	0	10	170	7.06%	12.82%
1G2	2	0	15	360	4.72%	11.86%

Subject 10

	INS	DEL	SUB	WORDS	WER	SER
LAB	8	0	13	346	6.07%	9.65%
HANGAR	7	0	20	343	7.87%	15.93%
1G1	0	0	2	339	0.59%	1.79%
4G	7	0	14	152	13.82%	14.49%
1G2	3	0	12	345	4.35%	8.77%

Subject 11

	INS	DEL	SUB	WORDS	WER	SER
LAB	4	0	10	343	4.08%	7.08%
HANGAR	4	1	13	341	5.28%	7.96%
1G1	10	0	21	330	9.39%	15.74%
4G	8	0	9	151	11.26%	7.35%
1G2	9	0	17	346	7.51%	11.40%

Subject 12

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	5	336	1.49%	4.46%
HANGAR	0	0	5	346	1.45%	4.39%
1G1	3	0	4	343	2.04%	2.65%
4G	7	0	9	155	10.32%	9.86%
1G2	0	0	7	346	2.02%	5.26%

APPENDIX D (Continued)

English-8K-030502, WTW=150

Subject 1

	INS	DEL	SUB	WORDS	WER	SER
LAB	6	0	8	346	4.05%	4.39%
HANGAR	5	0	17	345	6.38%	14.16%
1G1	10	0	29	346	11.27%	21.05%
4G	27	1	35	157	40.13%	28.17%
1G2	8	1	27	344	10.47%	19.47%

Subject 2

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	6	346	1.73%	5.26%
HANGAR	0	0	2	338	0.59%	1.80%
1G1	0	0	10	342	2.92%	8.04%
4G	12	0	39	151	33.77%	37.68%
1G2	11	5	40	326	17.18%	25.23%

Subject 3

	INS	DEL	SUB	WORDS	WER	SER
LAB	3	0	4	346	2.02%	2.63%
HANGAR	6	0	15	383	5.48%	10.57%
1G1	0	0	5	426	1.17%	3.65%
4G	22	0	30	210	24.76%	19.59%
1G2	11	0	24	452	7.74%	13.57%

Subject 4

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	7	351	1.99%	6.09%
HANGAR	0	0	6	346	1.73%	5.26%
1G1	0	0	3	365	0.82%	2.54%
4G	0	1	6	157	4.46%	7.04%
1G2	3	0	4	374	1.87%	2.50%

Subject 5

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	7	339	2.06%	6.31%
HANGAR	9	0	12	341	6.16%	7.14%
1G1	3	1	5	346	2.60%	4.39%
4G	4	2	25	150	20.67%	27.94%
1G2	0	0	5	346	1.45%	4.39%

Subject 6

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	344	0.29%	0.88%
HANGAR	0	0	3	346	0.87%	2.63%
1G1	3	0	3	343	1.75%	1.77%
4G	7	2	11	154	12.99%	10.00%
1G2	4	0	8	346	3.47%	4.39%

Subject 7

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	346	0.29%	0.88%
HANGAR	0	0	1	306	0.33%	0.99%
1G1	0	0	0	347	0.00%	0.00%
4G	0	0	2	154	1.30%	2.86%
1G2	0	0	2	346	0.58%	1.75%

Subject 8

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	346	0.29%	0.88%
HANGAR	0	0	0	346	0.00%	0.00%
1G1	0	0	1	346	0.29%	0.88%
4G	3	0	2	154	3.25%	1.43%
1G2	0	0	0	346	0.00%	0.00%

Subject 9

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	352	0.00%	0.00%
HANGAR	0	0	2	346	0.58%	1.75%
1G1	0	0	4	346	1.16%	1.75%
4G	0	0	3	170	1.76%	3.85%
1G2	5	1	17	360	6.39%	13.56%

Subject 10

	INS	DEL	SUB	WORDS	WER	SER
LAB	8	0	13	346	6.07%	8.77%
HANGAR	4	1	24	343	8.45%	20.35%
1G1	2	0	3	339	1.47%	2.68%
4G	7	0	15	152	14.47%	14.49%
1G2	3	0	12	345	4.35%	7.89%

Subject 11

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	2	343	0.58%	1.77%
HANGAR	0	1	11	341	3.52%	9.73%
1G1	0	1	15	330	4.85%	13.89%
4G	3	0	15	151	11.92%	13.24%
1G2	1	0	15	346	4.62%	13.16%

Subject 12

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	336	0.00%	0.00%
HANGAR	0	0	3	346	0.87%	2.63%
1G1	0	0	6	343	1.75%	5.31%
4G	4	0	6	155	6.45%	7.04%
1G2	1	1	6	346	2.31%	6.14%

APPENDIX D (Continued)

models-8khz / WTW=200

	INS	DEL	SUB	WORDS	WER	
LAB	127	2	152	3805	7.39%	
HANGAR	118	3	179	3781	7.93%	7.7%
1G1	79	2	134	3876	5.55%	
4G	207	5	250	1760	26.25%	
1G2	142	3	247	3931	9.97%	11.2%
Totals	673	15	962	17153	9.62%	

Subject	LAB	HANGAR	1G1	4G	1G2
1	12.72%	14.49%	14.74%	47.13%	20.06%
2	12.14%	7.10%	7.31%	44.37%	22.39%
3	9.54%	8.36%	11.03%	29.52%	11.73%
4	1.99%	6.07%	3.01%	6.37%	1.87%
5	7.96%	8.21%	0.87%	42.00%	10.69%
6	9.59%	4.62%	5.83%	20.78%	6.36%
7	2.02%	3.27%	0.00%	3.90%	0.00%
8	2.60%	3.18%	2.02%	14.94%	3.18%
9	5.97%	4.34%	1.45%	24.12%	10.83%
10	9.54%	17.78%	1.18%	28.95%	7.83%
11	7.29%	9.38%	12.73%	26.49%	15.61%
12	2.68%	2.89%	3.79%	11.61%	6.94%

English-8K-030502 / WTW=200

	INS	DEL	SUB	WORDS	WER	
LAB	57	4	192	3805	6.65%	
HANGAR	69	40	275	3781	10.16%	8.4%
1G1	55	7	165	3876	5.86%	
4G	139	15	335	1760	27.78%	
1G2	114	29	352	3931	12.59%	12.7%
Totals	434	95	1319	17153	10.77%	

Subject	LAB	HANGAR	1G1	4G	1G2
1	12.14%	13.33%	13.58%	47.77%	24.42%
2	9.54%	6.21%	7.89%	45.70%	36.20%
3	6.36%	12.53%	9.62%	44.29%	15.71%
4	10.54%	7.80%	3.29%	8.28%	5.08%
5	7.08%	13.20%	6.36%	40.00%	6.65%
6	2.03%	1.16%	4.96%	23.38%	10.12%
7	0.29%	0.33%	0.00%	3.25%	0.58%
8	0.29%	1.45%	0.58%	5.84%	1.73%
9	3.41%	0.87%	1.73%	17.06%	13.33%
10	14.45%	44.90%	5.60%	30.26%	11.88%
11	7.00%	8.80%	10.30%	35.76%	13.87%
12	0.00%	5.78%	4.96%	21.94%	7.80%

APPENDIX D (Continued)

models-8khz, WTW=200

Subject 1

	INS	DEL	SUB	WORDS	WER	SER
LAB	20	0	24	346	12.72%	14.91%
HANGAR	19	0	31	345	14.49%	20.35%
1G1	17	0	34	346	14.74%	24.56%
4G	34	1	39	157	47.13%	33.80%
1G2	22	2	45	344	20.06%	29.20%

Subject 2

	INS	DEL	SUB	WORDS	WER	SER
LAB	20	0	22	346	12.14%	13.16%
HANGAR	12	0	12	338	7.10%	6.31%
1G1	10	0	15	342	7.31%	9.82%
4G	25	1	41	151	44.37%	33.33%
1G2	24	1	48	326	22.39%	27.93%

Subject 3

	INS	DEL	SUB	WORDS	WER	SER
LAB	18	0	15	346	9.54%	7.89%
HANGAR	15	0	17	383	8.36%	9.76%
1G1	22	0	25	426	11.03%	13.87%
4G	30	0	32	210	29.52%	21.65%
1G2	20	0	33	452	11.73%	18.57%

Subject 4

	INS	DEL	SUB	WORDS	WER	SER
LAB	2	0	5	351	1.99%	3.48%
HANGAR	9	0	12	346	6.07%	8.77%
1G1	3	0	8	365	3.01%	5.93%
4G	3	0	7	157	6.37%	8.45%
1G2	2	0	5	374	1.87%	4.17%

Subject 5

	INS	DEL	SUB	WORDS	WER	SER
LAB	8	0	19	339	7.96%	14.41%
HANGAR	9	0	19	341	8.21%	14.29%
1G1	0	1	2	346	0.87%	2.63%
4G	23	2	38	150	42%	32.35%
1G2	14	0	23	346	10.69%	15.79%

Subject 6

	INS	DEL	SUB	WORDS	WER	SER
LAB	17	0	16	344	9.59%	8.85%
HANGAR	6	0	10	346	4.62%	7.02%
1G1	10	0	10	343	5.83%	5.31%
4G	16	0	16	154	20.78%	14.29%
1G2	12	0	10	346	6.36%	5.26%

Subject 7

	INS	DEL	SUB	WORDS	WER	SER
LAB	2	0	5	346	2.02%	2.63%
HANGAR	6	0	4	306	3.27%	1.98%
1G1	0	0	0	347	0%	0%
4G	3	0	3	154	3.90%	2.86%
1G2	0	0	0	346	0%	0%

Subject 8

	INS	DEL	SUB	WORDS	WER	SER
LAB	4	0	5	346	2.60%	2.63%
HANGAR	6	0	5	346	3.18%	2.63%
1G1	3	0	4	346	2.02%	2.63%
4G	11	0	12	154	14.94%	10%
1G2	5	0	6	346	3.18%	2.63%

Subject 9

	INS	DEL	SUB	WORDS	WER	SER
LAB	13	0	8	352	5.97%	4.31%
HANGAR	9	0	6	346	4.34%	3.51%
1G1	0	0	5	346	1.45%	4.39%
4G	20	0	21	170	24.12%	20.51%
1G2	14	0	25	360	10.83%	15.25%

Subject 10

	INS	DEL	SUB	WORDS	WER	SER
LAB	13	2	18	346	9.54%	14.91%
HANGAR	21	0	40	343	17.78%	26.55%
1G1	0	0	4	339	1.18%	3.57%
4G	20	1	23	152	28.95%	21.74%
1G2	8	0	19	345	7.83%	14.04%

Subject 11

	INS	DEL	SUB	WORDS	WER	SER
LAB	10	0	15	343	7.29%	9.73%
HANGAR	6	3	23	341	9.38%	15.04%
1G1	14	1	27	330	12.73%	20.37%
4G	22	0	18	151	26.49%	13.24%
1G2	21	0	33	346	15.61%	21.93%

Subject 12

	INS	DEL	SUB	WORDS	WER	SER
LAB	3	0	6	336	2.68%	4.46%
HANGAR	3	0	7	346	2.80%	5.26%
1G1	3	0	10	343	3.79%	7.96%
4G	7	0	11	155	11.61%	11.27%
1G2	7	0	17	346	6.94%	11.40%

APPENDIX D (Continued)

English-8K-030502, WTW=200

Subject 1

	INS	DEL	SUB	WORDS	WER	SER
LAB	10	1	31	346	12.14%	21.93%
HANGAR	9	4	33	345	13.33%	23.89%
1G1	13	3	31	346	13.58%	22.81%
4G	31	1	43	157	47.77%	38.03%
1G2	16	6	62	344	24.42%	34.51%

Subject 2

	INS	DEL	SUB	WORDS	WER	SER
LAB	7	0	26	346	9.54%	16.67%
HANGAR	11	0	10	338	6.21%	5.41%
1G1	4	0	23	342	7.89%	16.96%
4G	12	3	54	151	45.70%	53.62%
1G2	18	11	89	326	36.20%	49.55%

Subject 3

	INS	DEL	SUB	WORDS	WER	SER
LAB	6	0	16	346	6.36%	11.40%
HANGAR	16	0	32	383	12.53%	21.14%
1G1	13	2	26	426	9.62%	15.33%
4G	30	1	62	210	44.29%	44.33%
1G2	19	6	46	452	15.71%	27.14%

Subject 4

	INS	DEL	SUB	WORDS	WER	SER
LAB	6	2	29	351	10.54%	20.87%
HANGAR	4	0	23	346	7.80%	17.54%
1G1	0	0	12	365	3.29%	7.63%
4G	3	1	9	157	8.28%	9.86%
1G2	5	1	13	374	5.08%	9.17%

Subject 5

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	1	23	339	7.08%	17.12%
HANGAR	12	2	31	341	13.20%	20.54%
1G1	10	1	11	346	6.36%	6.14%
4G	11	5	44	150	40%	42.65%
1G2	3	0	20	346	6.65%	12.28%

Subject 6

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	7	344	2.03%	6.19%
HANGAR	0	0	4	346	1.16%	3.51%
1G1	7	0	10	343	4.96%	6.19%
4G	10	2	24	154	23.38%	22.86%
1G2	13	1	21	346	10.12%	12.28%

Subject 7

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	346	0.29%	0.88%
HANGAR	0	0	1	306	0.33%	0.99%
1G1	0	0	0	347	0%	0%
4G	0	0	5	154	3.25%	5.71%
1G2	0	0	2	346	0.58%	1.75%

Subject 8

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	1	346	0.29%	0.88%
HANGAR	3	0	2	346	1.45%	0.88%
1G1	0	0	2	346	0.58%	1.75%
4G	3	0	6	154	5.84%	5.71%
1G2	3	0	3	346	1.73%	1.75%

Subject 9

	INS	DEL	SUB	WORDS	WER	SER
LAB	4	0	8	352	3.41%	5.17%
HANGAR	0	0	3	346	0.87%	2.63%
1G1	0	0	6	346	1.73%	3.51%
4G	11	0	18	170	17.06%	17.95%
1G2	16	1	31	360	13.33%	20.34%

Subject 10

	INS	DEL	SUB	WORDS	WER	SER
LAB	16	0	34	346	14.45%	21.05%
HANGAR	11	31	112	343	44.90%	64.60%
1G1	2	0	17	339	5.60%	11.61%
4G	11	1	34	152	30.26%	30.43%
1G2	10	1	30	345	11.88%	19.30%

Subject 11

	INS	DEL	SUB	WORDS	WER	SER
LAB	8	0	16	343	7%	8.85%
HANGAR	3	3	24	341	8.80%	21.24%
1G1	6	1	27	330	10.30%	22.22%
4G	17	1	36	151	35.76%	35.29%
1G2	11	2	35	346	13.87%	27.19%

Subject 12

	INS	DEL	SUB	WORDS	WER	SER
LAB	0	0	0	336	0%	0%
HANGAR	6	0	14	346	5.78%	8.77%
1G1	0	1	16	343	4.96%	14.16%
4G	9	0	25	155	21.94%	25.35%
1G2	4	2	21	346	7.80%	16.67%

APPENDIX E: DYNASPEAK VISTA GRAMMAR FILE

```

declutter = d i y k l a h t e r;
nav = n a e v;

<Digit0_9> = zero | one | two | three | four | five | six | seven | eight |
nine | niner;

<Digit5_9> = five | six | seven | eight | nine | niner;

<Digit3_9> = three | four | five | six | seven | eight | nine | niner;

<Digit0257> = zero | two | five | seven;

<Finish_UHF> = (<Digit0_9> <Digit0257> enter) | (<Digit0_9> enter) | enter;

<UHF_Freq> = (two two <Digit5_9> <Finish_UHF>) | (two <Digit3_9> <Digit0_9>
<Finish_UHF>) |
(three <Digit0_9> <Digit0_9> <Finish_UHF>);

public <Command> = (uniform <UHF_Freq>) |
(sample background noise) |
(missile override) |
(missile step) |
(nav mode) |
(declutter (hud | helmet)) |
(normal (hud | helmet)) |
dogfight |
(say (altitude | heading | mach | fuel)) |
(say (true | calibrated) airspeed) |
(say target info);

```

APPENDIX F:

VISTA WORD ERROR RATES BY FLIGHT

models-8khz / WTW=-200

	INS	DEL	SUB	WORDS	WER
All Flights	0	25	79	3162	3.29%

Flight	INS	DEL	SUB	WORDS	WER
flt490_s05	0	0	1	199	0.50%
flt492_s03	0	2	5	366	1.91%
flt493_s09	0	0	0	452	0.00%
flt494_s01	0	0	8	315	2.54%
flt495	0	0	3	367	0.82%
flt496	0	1	1	171	1.17%
flt498	0	0	1	179	0.56%
flt499	0	2	4	144	4.17%
flt500	0	19	41	446	13.45%
flt502	0	1	9	181	5.52%
flt503	0	0	1	195	0.51%
flt504	0	0	5	147	3.40%

English-8K-030502 / WTW=-200

	INS	DEL	SUB	WORDS	WER
All Flights	1	17	61	3162	2.50%

Flight	INS	DEL	SUB	WORDS	WER
flt490_s05	0	1	6	199	3.52%
flt492_s03	0	0	6	366	1.64%
flt493_s09	0	0	0	452	0.00%
flt494_s01	0	0	6	315	1.90%
flt495	0	0	5	367	1.36%
flt496	0	0	0	171	0.00%
flt498	0	0	1	179	0.56%
flt499	0	0	0	144	0.00%
flt500	1	15	28	446	9.87%
flt502	0	1	8	181	4.97%
flt503	0	0	1	195	0.51%
flt504	0	0	0	147	0.00%

APPENDIX F (Continued)

models-8khz / WTW=-150

	INS	DEL	SUB	WORDS	WER
All Flights	1	21	73	3162	3.00%

Flight	INS	DEL	SUB	WORDS	WER
flt490_s05	0	0	1	199	0.50%
flt492_s03	0	1	4	366	1.37%
flt493_s09	0	0	0	452	0.00%
flt494_s01	0	0	8	315	2.54%
flt495	0	0	4	367	1.09%
flt496	0	1	1	171	1.17%
flt498	0	0	0	179	0.00%
flt499	0	2	4	144	4.17%
flt500	1	17	33	446	11.43%
flt502	0	0	11	181	6.08%
flt503	0	0	1	195	0.51%
flt504	0	0	6	147	4.08%

English-8K-030502 / WTW=-150

	INS	DEL	SUB	WORDS	WER
All Flights	3	7	57	3162	2.12%

Flight	INS	DEL	SUB	WORDS	WER
flt490_s05	1	1	6	199	4.02%
flt492_s03	0	0	6	366	1.64%
flt493_s09	1	0	0	452	0.22%
flt494_s01	0	0	6	315	1.90%
flt495	0	0	5	367	1.36%
flt496	0	0	0	171	0.00%
flt498	0	0	1	179	0.56%
flt499	0	0	0	144	0.00%
flt500	1	6	23	446	6.73%
flt502	0	0	8	181	4.42%
flt503	0	0	1	195	0.51%
flt504	0	0	1	147	0.68%

APPENDIX F (Continued)

models-8khz / WTW=-100

	INS	DEL	SUB	WORDS	WER
All Flights	2	18	68	3162	2.78%

Flight	INS	DEL	SUB	WORDS	WER
flt490_s05	0	0	1	199	0.50%
flt492_s03	0	0	2	366	0.55%
flt493_s09	0	0	0	452	0.00%
flt494_s01	1	0	9	315	3.17%
flt495	0	0	5	367	1.36%
flt496	0	1	1	171	1.17%
flt498	0	0	0	179	0.00%
flt499	0	2	4	144	4.17%
flt500	1	15	33	446	10.99%
flt502	0	0	6	181	3.31%
flt503	0	0	1	195	0.51%
flt504	0	0	6	147	4.08%

English-8K-030502 / WTW=-100

	INS	DEL	SUB	WORDS	WER
All Flights	4	6	53	3162	1.99%

Flight	INS	DEL	SUB	WORDS	WER
flt490_s05	2	1	7	199	5.03%
flt492_s03	0	0	6	366	1.64%
flt493_s09	1	0	2	452	0.66%
flt494_s01	0	0	6	315	1.90%
flt495	0	0	5	367	1.36%
flt496	0	0	0	171	0.00%
flt498	0	0	1	179	0.56%
flt499	0	0	0	144	0.00%
flt500	1	5	19	446	5.61%
flt502	0	0	6	181	3.31%
flt503	0	0	1	195	0.51%
flt504	0	0	0	147	0.00%

APPENDIX F (Continued)

models-8khz / WTW=-50

	INS	DEL	SUB	WORDS	WER
All Flights	1	12	61	3162	2.34%

Flight	INS	DEL	SUB	WORDS	WER
flt490_s05	0	0	1	199	0.50%
flt492_s03	0	0	1	366	0.27%
flt493_s09	0	0	0	452	0.00%
flt494_s01	0	0	10	315	3.17%
flt495	0	0	4	367	1.09%
flt496	0	0	0	171	0.00%
flt498	0	0	0	179	0.00%
flt499	0	2	4	144	4.17%
flt500	1	10	27	446	8.52%
flt502	0	0	5	181	2.76%
flt503	0	0	1	195	0.51%
flt504	0	0	8	147	5.44%

English-8K-030502 / WTW=-50

	INS	DEL	SUB	WORDS	WER
All Flights	6	4	54	3162	2.02%

Flight	INS	DEL	SUB	WORDS	WER
flt490_s05	2	1	7	199	5.03%
flt492_s03	0	0	6	366	1.64%
flt493_s09	1	0	1	452	0.44%
flt494_s01	0	0	6	315	1.90%
flt495	2	0	5	367	1.91%
flt496	0	0	0	171	0.00%
flt498	0	0	1	179	0.56%
flt499	0	0	0	144	0.00%
flt500	1	3	20	446	5.38%
flt502	0	0	7	181	3.87%
flt503	0	0	1	195	0.51%
flt504	0	0	0	147	0.00%

APPENDIX F (Continued)

models-8khz / WTW=0

	INS	DEL	SUB	WORDS	WER
All Flights	2	9	62	3162	2.31%

Flight	INS	DEL	SUB	WORDS	WER
flt490_s05	0	0	2	199	1.01%
flt492_s03	0	0	1	366	0.27%
flt493_s09	1	0	0	452	0.22%
flt494_s01	0	0	11	315	3.49%
flt495	1	0	4	367	1.36%
flt496	0	0	0	171	0.00%
flt498	0	0	0	179	0.00%
flt499	0	1	3	144	2.78%
flt500	0	8	28	446	8.07%
flt502	0	0	4	181	2.21%
flt503	0	0	1	195	0.51%
flt504	0	0	8	147	5.44%

English-8K-030502 / WTW=0

	INS	DEL	SUB	WORDS	WER
All Flights	9	3	55	3162	2.12%

Flight	INS	DEL	SUB	WORDS	WER
flt490_s05	2	1	6	199	4.52%
flt492_s03	1	0	4	366	1.37%
flt493_s09	1	0	1	452	0.44%
flt494_s01	1	0	6	315	2.22%
flt495	3	0	6	367	2.45%
flt496	0	0	0	171	0.00%
flt498	1	0	1	179	1.12%
flt499	0	0	0	144	0.00%
flt500	0	2	24	446	5.83%
flt502	0	0	6	181	3.31%
flt503	0	0	1	195	0.51%
flt504	0	0	0	147	0.00%

APPENDIX F (Continued)

models-8khz / WTW=50

	INS	DEL	SUB	WORDS	WER
All Flights	8	5	61	3162	2.34%

Flight	INS	DEL	SUB	WORDS	WER
flt490_s05	2	0	3	199	2.51%
flt492_s03	1	0	1	366	0.55%
flt493_s09	2	0	0	452	0.44%
flt494_s01	1	0	12	315	4.13%
flt495	2	0	3	367	1.36%
flt496	0	0	0	171	0.00%
flt498	0	0	0	179	0.00%
flt499	0	1	3	144	2.78%
flt500	0	4	27	446	6.95%
flt502	0	0	4	181	2.21%
flt503	0	0	1	195	0.51%
flt504	0	0	7	147	4.76%

English-8K-030502 / WTW=50

	INS	DEL	SUB	WORDS	WER
All Flights	16	2	56	3162	2.34%

Flight	INS	DEL	SUB	WORDS	WER
flt490_s05	3	1	6	199	5.03%
flt492_s03	3	0	4	366	1.91%
flt493_s09	3	0	1	452	0.88%
flt494_s01	2	0	8	315	3.17%
flt495	3	0	5	367	2.18%
flt496	0	0	0	171	0.00%
flt498	1	0	1	179	1.12%
flt499	0	0	0	144	0.00%
flt500	1	1	24	446	5.83%
flt502	0	0	6	181	3.31%
flt503	0	0	1	195	0.51%
flt504	0	0	0	147	0.00%

APPENDIX F (Continued)

models-8khz / WTW=100

	INS	DEL	SUB	WORDS	WER
All Flights	12	4	53	3162	2.18%

Flight	INS	DEL	SUB	WORDS	WER
flt490_s05	2	0	2	199	2.01%
flt492_s03	1	0	1	366	0.55%
flt493_s09	3	0	0	452	0.66%
flt494_s01	1	0	10	315	3.49%
flt495	3	0	4	367	1.91%
flt496	0	0	0	171	0.00%
flt498	0	0	0	179	0.00%
flt499	0	1	3	144	2.78%
flt500	1	3	26	446	6.73%
flt502	0	0	0	181	0.00%
flt503	0	0	1	195	0.51%
flt504	1	0	6	147	4.76%

English-8K-030502 / WTW=100

	INS	DEL	SUB	WORDS	WER
All Flights	20	3	65	3162	2.78%

Flight	INS	DEL	SUB	WORDS	WER
flt490_s05	2	1	9	199	6.03%
flt492_s03	4	0	4	366	2.19%
flt493_s09	3	0	2	452	1.11%
flt494_s01	2	0	7	315	2.86%
flt495	3	0	5	367	2.18%
flt496	0	0	0	171	0.00%
flt498	1	0	2	179	1.68%
flt499	1	0	1	144	1.39%
flt500	4	2	32	446	8.52%
flt502	0	0	2	181	1.10%
flt503	0	0	1	195	0.51%
flt504	0	0	0	147	0.00%

APPENDIX F (Continued)

models-8khz / WTW=150

	INS	DEL	SUB	WORDS	WER
All Flights	17	3	76	3162	3.04%

Flight	INS	DEL	SUB	WORDS	WER
flt490_s05	2	0	6	199	4.02%
flt492_s03	3	0	3	366	1.64%
flt493_s09	3	0	3	452	1.33%
flt494_s01	2	0	10	315	3.81%
flt495	3	0	5	367	2.18%
flt496	0	0	0	171	0.00%
flt498	0	0	0	179	0.00%
flt499	2	0	4	144	4.17%
flt500	1	3	35	446	8.74%
flt502	0	0	0	181	0.00%
flt503	0	0	2	195	1.03%
flt504	1	0	8	147	6.12%

English-8K-030502 / WTW=150

	INS	DEL	SUB	WORDS	WER
All Flights	21	6	97	3162	3.92%

Flight	INS	DEL	SUB	WORDS	WER
flt490_s05	2	1	12	199	7.54%
flt492_s03	5	0	5	366	2.73%
flt493_s09	4	0	6	452	2.21%
flt494_s01	2	0	14	315	5.08%
flt495	3	0	4	367	1.91%
flt496	0	0	0	171	0.00%
flt498	1	0	2	179	1.68%
flt499	1	0	1	144	1.39%
flt500	3	5	50	446	13.00%
flt502	0	0	2	181	1.10%
flt503	0	0	1	195	0.51%
flt504	0	0	0	147	0.00%

APPENDIX F (Continued)

models-8khz / WTW=-200

	INS	DEL	SUB	WORDS	WER
All Flights	25	4	141	3162	5.38%

Flight	INS	DEL	SUB	WORDS	WER
flt490_s05	2	0	11	199	6.53%
flt492_s03	6	0	5	366	3.01%
flt493_s09	2	0	9	452	2.43%
flt494_s01	4	0	19	315	7.30%
flt495	4	0	5	367	2.45%
flt496	0	0	2	171	1.17%
flt498	1	0	1	179	1.12%
flt499	2	0	4	144	4.17%
flt500	3	4	71	446	17.49%
flt502	0	0	3	181	1.66%
flt503	0	0	3	195	1.54%
flt504	1	0	8	147	6.12%

English-8K-030502 / WTW=200

	INS	DEL	SUB	WORDS	WER
All Flights	20	33	231	3162	8.98%

Flight	INS	DEL	SUB	WORDS	WER
flt490_s05	2	1	27	199	15.08%
flt492_s03	4	4	36	366	12.02%
flt493_s09	3	1	14	452	3.98%
flt494_s01	5	6	43	315	17.14%
flt495	3	0	4	367	1.91%
flt496	0	0	0	171	0.00%
flt498	1	0	2	179	1.68%
flt499	1	0	1	144	1.39%
flt500	1	20	93	446	25.56%
flt502	0	1	4	181	2.76%
flt503	0	0	1	195	0.51%
flt504	0	0	6	147	4.08%